SCIENCE LIBRARY SEP 27 1926

September 25, 1926

McGraw-Hill Publishing Company, Inc.

Price Twenty-five Cents Per Copy

ENGINEERING AND MINING JOURNAL

A Consolidation of Engineering and Mining Journal and Mining and Scientific Press

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

Smelter and refinery of Nichols Copper Company, at Laurel Hill, New York City, as seen from an airplane.

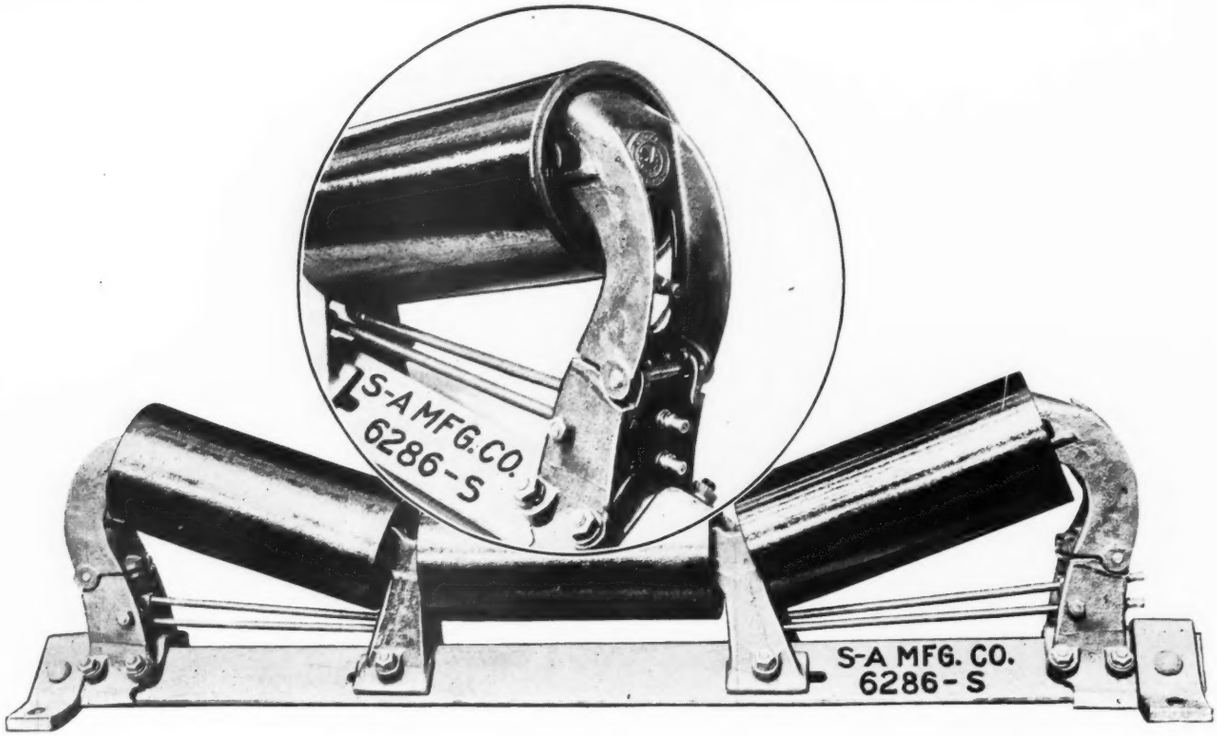
Here a large part of Katanga's copper is refined. One of the two series refineries in the country.

Fundamental Hoisting Problems-I, by Allan B. Calhoun

Successive Banding Around Rock Fragments in Veins, by J. E. Spurr

Cananea Smelter Practice, by A. D. Wilkinson

Next Week—Report of Western States Mining Convention in Denver



Belt conveyors—the modern handling method

Mechanical conveying is everywhere displacing different forms of transporting ore and other bulk materials, and more and more mines and mills are installing belt conveyors for work formerly handled in other ways.

Operating as they do with low power consumption and with long belt life, S-A belt conveyors transport materials at the very lowest cost per ton.

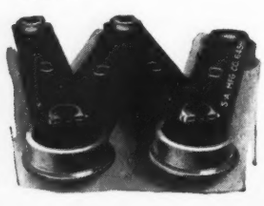
Only a short time ago Stephens-Adamson Mfg. Co. designed and built a conveyor system over four miles in length!

The Sacon Carrier shown above is one of the types of S-A ball-bearing, high-pressure lubricated carriers which are noted for durability, smooth, easy turning rolls, and long service life.

The illustration above shows a Sacon Carrier, specially equipped with outside lubrication fittings.

S-A Chains

Chains of every variety for elevating and conveying service, from smallest hand chain to mammoth steel bushed roller chain, listed in S-A Catalog No. 27.



Stephens-Adamson Mfg. Co.

AURORA, ILLINOIS

Pacific Coast Factory—Los Angeles, Cal.

STEPHENS-ADAMSON

S-A BELT CONVEYORS

Volume 122 New York, September 25, 1926 *Number* 13

ENGINEERING AND MINING JOURNAL

J. E. SPURR, Editor

GEORGE J. YOUNG, Associate Editor, San Francisco, Calif. T. A. RICKARD, Contributing Editor, San Francisco, Calif.
A. H. HUBBELL, Managing Editor
E. H. ROBIE, A. B. PARSONS, ALBERT H. FAY, W. N. P. REED, Assistant Editors
Tenth Ave. at 36th St., New York, N. Y.
883 Mission St., San Francisco, Calif. Colorado Building Washington, D. C.

Contents

*Illustrated Article

Editorials 481
- Growth of Combinations
- No Venture Without Venturing
- The Locarno Treaty
- Hard-Headed Business Men
- Progress of Science
- Goggles and the Mining Industries

***At the Recent First Aid and Mine Rescue Meeting in California** 484
- Illustrations

Fundamental Hoisting Problems—I 485
- By Allan B. Calhoun

***Successive Banding Around Rock Fragments in Veins** 491
- By J. E. Spurr

Legendary Diamond Mines of Brazil 498
- By Charles N. Lurie

Detonators and Tests for Detonators 500

Cananea Smelter Improves Reverberatory Practice 501
- By A. D. Wilkinson

Discussion 502
- Favors American Gold Dredges and Engineers
- Geological Features of Bolivia's Tin-Bearing Veins

Mining News 504
- Utah Mining Dividends
- Abandoned Prospect May Become Mine
- California Hydraulic Mining
- Mining Progress in Japan
- Washington News
- Letters from London, Toronto, Mexico City, Paris and Johannesburg

Societies, Addresses and Reports 511

Men You Should Know About 512

Obituaries 512

Recent Technical Publications 513

New Machinery 514

Markets 515

Company Reports and Mining Dividends 517

Current Prices of Mining Supplies 519

Mining Stocks 520

Searchlight Section 40-42

Professional Directory 43

What and Where to Buy 46-48

Advertising Index 50

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

JAMES H. McGRAW, President
JAMES H. McGRAW, Jr., Vice-Pres. and Treas
MALCOLM MUIR, Vice-President
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
C. H. THOMPSON, Secretary

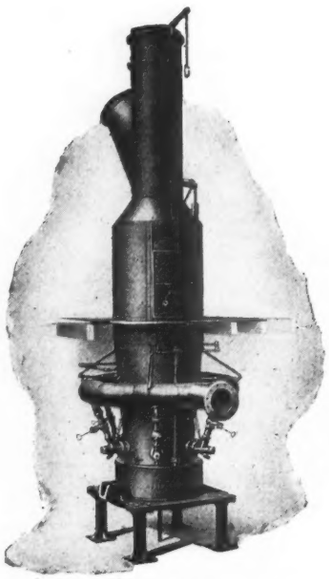
WASHINGTON, Colorado Building
CHICAGO, 7 S. Dearborn Street
PHILADELPHIA, 16th and Parkway
CLEVELAND, Guardian Building
ST. LOUIS, Star Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E. C. 4

Cable Address: "Machinist, N. Y."
Copyright 1926
By McGraw-Hill Publishing Company, Inc.
Publishers of
Engineering News-Record American Machinist
Power Chemical and Metallurgical Engineering
Coal Age Engineering and Mining Journal
Ingeniería Internacional
Electrical World Electrical Merchandising
Bus Transportation Electric Railway Journal
Industrial Engineer Radio Retailing
Successful Methods
Journal of Electricity
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

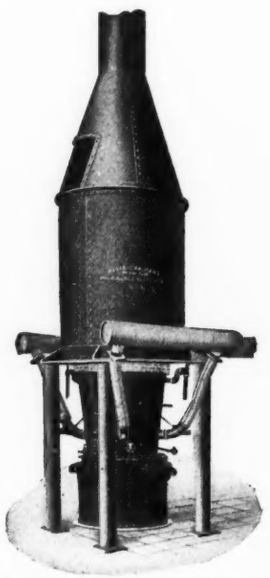
The annual subscription rate in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Chili, Haiti and Paraguay, $5 per year. Extra foreign postage, $3 (total $8 or 34 shillings). Single copy, 25c. Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at New York at least ten days before the change takes place. Published weekly. Entered as second-class matter June 20, 1879, at the Post Office at New York N. Y., under the Act of March 3, 1879.
Printed in U. S. A.
Member Audit Bureau of Circulations.
Member Associated Business Papers, Inc.

11,650 COPIES PRINTED THIS ISSUE

Water Jacketed Blast Furnaces for Copper and Lead Ores



36-in. Round Steel Water Jacketed Blast Furnace for Smelting Copper Ores



Round Steel Water Jacketed Blast Furnace for Smelting Lead Ores

Small Copper and Lead Furnaces for use in remote districts and small mines. Built in various sizes.

Can be furnished sectional for mule back transportation. Estimates furnished upon receipt of inquiry with full information regarding capacity and requirements.

Complete Equipment
for
Mine, Mill and Smelter

ALLIS-CHALMERS PRODUCTS
Electrical Machinery
Steam Turbines
Steam Engines
Gas and Oil Engines
Hydraulic Turbines
Crushing and Cement Machinery
Mining Machinery

ALLIS-CHALMERS MANUFACTURING COMPANY

MILWAUKEE, WISCONSIN. U.S.A.

ALLIS-CHALMERS PRODUCTS
Flour and Saw Mill Machinery
Power Transmission Machinery
Pumping Engines-Centrifugal Pumps
Steam and Electric Hoists
Air Compressors - Air Brakes
Agricultural Machinery
Condensers

ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

Volume 122 | New York, September 25, 1926 | *Number* 13

Growth of Combinations

IT IS NOT DIFFICULT to foresee that the future development in mining will tend to be as in the immediate past, toward larger and larger organizations or combinations of mining capital and enterprise. This is the general trend of the times in all industry, and from the social and political, as well as the economic point of view, is a thing to be studied and watched as to its development. Such organization is clearly opposed to individualism, the ideal upon which the theory of democracy is founded: nevertheless, it is evident in democracies like the United States and France, following the lessons as to its efficiency that have been shown in countries like pre-war Germany, then more autocratic or aristocratic in its system. In the United States the farmer is urged to enter into agrarian combines, and it is likely soon that the idea will be expressed in laws. The present administration tells him that his salvation lies in limiting production, controlling distribution, standing together on price, and those other activities which characterize the typical business combine. It is true, indeed, that in some parts of the country such agricultural marketing contributions have proven their practical value. In the case of certain metals and minerals, there exists a varying degree of control through similar means—control which safeguards the interest of the producer against the purchaser. Aluminum, cobalt, molybdenum, nickel and other metals are so handled; and the Copper Export Association, as planned, may develop into a control of the orderly and profitable marketing of the world's copper. One of the reasons for this move is reported to have been the forming of a purchasing syndicate by German copper buyers; which was held to necessitate a sellers' syndicate, so that the phrase "collective bargaining" so often heard in labor-capital difficulties, would apply in this instance. World-consortiums offer, of course, a menace to industry, if the power is abused; but this should not be permitted.

In general, the effectiveness of the larger combination has been demonstrated. The chain stores have largely replaced the independents, the great industrial combinations like U. S. Steel and General Motors, thrive while smaller organizations in the vicissitudes of their fortunes go up and down.

The principle of distribution of risk and striking a smoother average makes these continuous and successful: and the same applies to the larger mining organizations. Smaller companies stand or fall on one mine, and hence, like individuals, have periods of extravagance-inciting prosperity and other periods when there is not enough to pay the bills; but the larger organization is gaining on one enterprise while it is losing on another, and so carrying all together through good times and bad.

No Venture Without Venturing

IN THE NORTHWEST a mining company is operating which has been financed by a method that may appear sound on first examination but which, nevertheless, may be misleading to the unthinking investor in the company. All capital subscribed is invested in sound bonds and only the income from the bonds used for exploration, development and equipment of the property. As a consequence the subscribing shareholder is told that his investment is never in danger, as all capital is kept intact and that even if the entire venture turns out disastrously the shareholder is assured of receiving his money back.

The hitch in this financial structure is obvious. In analyzing it, assume that a corporation is organized on the financial basis outlined, with a capital of $1,000,000 and that all the stock is sold at par and the proceeds invested in good bonds yielding 5 per cent. Then $50,000 interest is available for work on the company's holdings. This sum is sufficient to drive considerable footage of tunnels and shafts and to keep a small crew of men working steadily, not to mention the bread and butter it might provide for the officers of the corporation. In fact the ease with which this scheme perpetuates a livelihood for the officers of the company is one of its dangers.

Assume further that the venture proves successful and that a plant costing $300,000 is needed for steady production on a profitable basis. The shareholders would then have to wait about six years (while the property is idle) until $300,000 at simple interest accumulates from the interest on the bonds. Further financing might be tried but that would probably reduce the original investor's equity in the property. During the six-year wait the shareholders are also sacrificing the return on their money which they might have received had they invested it themselves directly in good bonds. This is money lost, or risked.

Moreover, even if the property is completely developed and equipped on the financial basis assumed, earnings from the property will have to be extraordinarily large to pay a fair return on the original capital invested. Each dollar of interest put in the venture will have to return not only itself but more than this to yield more than the 5 per cent bond interest on the original capital. How many new ventures in mining give more than a dollar back for every one which is put into it?

The scheme amounts to this: The intending investor of say $1,000 is not investing more than about $50 of it per year in mining—the rest goes into a bond that probably does not help mining in any way. This seems a small proportion of his capital to risk in helping to develop the mining industry. In mining, as in other businesses, there is a certain risk to be borne; perhaps it is higher in mining, but so is the prospect

of gain. The investor cannot have his cake and eat it too. If he subscribes to the full extent of his capital available for this purpose, without restriction, his chance of gain is greater than if he restricts his investment to the interest which his capital can earn. He must realize that even with the present scheme, the old rule of investments still holds: that the possibility of gain is inversely proportional to the degree of safety afforded by the enterprise.

The Locarno Treaty

THE FINAL RATIFICATION of the Locarno treaty between France and Germany, with England as a third party, is an event of prime importance in the history of the world, and may well be a turning point in the long chaotic and bloody development of European history. This history, since the arrival of the industrial era in the world, has to a very large extent centered around the struggle for the coal and iron fields which lie between Germany and France, and constitute the greatest steel making center in Europe, and the second in the world. This was finally the main motive behind the World War, the result of a tension and readiness to grapple which was as marked on the part of France as of Germany. Since the war, modern industrial organization, which is blazing the trail of international co-operation and amity for governments to follow, appears to have solved the problem by an economic combine between the French and German interests in this field, so that they represent an economic bloc, working to the material advantage of the Teutonic and Gallic inhabitants on both sides of the Rhine. Dr. Stresemann observed recently to Sir Philip Gibbs, newspaper correspondent, that "French and German economists and manufacturers had been pace makers for politicians, and industrial co-operation would help to break down political boundaries."

The going down of the World War tidal wave left republics on both sides of the international boundary—a form of government which hesitates on war and delays it until it becomes a necessity. These republics have now solemnly pledged themselves against future warring on one another, and England has pledged herself, should one of the contracting parties break the agreement, to herself enter the war against the aggressor, whether it be France or Germany. England's record of entering the war in behalf of Belgium when Germany broke her pledge with the little country is an adequate guarantee that this arrangement will be carried through to the letter—an arrangement so wise that the United States could well afford to line up her promises behind those of England, to equally do her share to enforce the peace. The United States, loath to enter the World War, eventually did so at great cost and sacrifice: it is vain to withdraw wholly from future responsibility, and to avoid taking those forceful positions which would in advance prevent war. Even without the support of the United States, the success of the Locarno treaty seems assured. In fact, war has proved disastrous to both parties contending for the Alsace-Lorraine-Ruhr coal and iron centers: both parties now agree to live in economic partnership, which they will find immensely profitable. It is difficult to doubt the sincerity of both Germany and France in this matter. In general, economic offensives of any one nation against another should not be undertaken except when absolutely necessary; and following this idea, most nations in Europe, as well as the United States, have much upon which they may improve.

Hard-Headed Business Men

FROM A CORRESPONDENT (a mining engineer) we have a letter which contains the following paragraph: "Another man called in, making circumspect inquiries about the future of copper. On drawing him out found that he claims to have a copper deposit 400 ft. in width and 30 per cent copper. He is a curious combination of the hard-headed business man thoroughly ignorant of mining."

Interesting though this is, it is not news, applying the well-known example that if a dog bites a man, it is not news: but if the man bites the dog—that is worthy of publicity. The hard-headed business man who falls an easy prey to the mining germ, is thrown into a high and permanent fever, and becomes unbalanced in the area of his cranium, is the usual phenomenon: when the said business man treats mining as he would any other business, this is a justification for head lines. Providence has doubtless supplied this phenomenon, for without this much digging would not be done: and once in a while something comes from it. The average result, of course, of all such enthusiasm, is overwhelmingly a total loss: but here and there a pay-streak is uncovered which adds to the total output, and the money of the hard-headed business man, paid out for wages and supplies, helps to keep up the personnel of the industry. The trouble is that such easy money does not always find its way into the blasting of rock and the meeting of pay-rolls. The sharks of the fraternity, who aim to introduce the hole in the ground to the successful business man, cannot exist in the luxury to which they would like to become accustomed, without diverting such funds largely to their own bank account. The field is a rich and enticing one, and the hard-headed business man possesses a psychology strikingly similar to that of the lawyer, school teacher, and small retired capitalist. This public, disillusioned on all else, would fain believe in the magic of mining—they beg to be taken in. From a lawyer of high standing we recently received the question, "Is it possible that George Graham Rice has really discovered a bonanza in Idaho Copper?" Assuredly: but not for the anxious inquirer: only for George Graham Rice and his confederates.

This bit of psychology is also held to explain as a charitable hypothesis why business men of hitherto good conduct and reputation, are found engaged in the mining business with and under the leadership of evident crooks. Absurd though the statements made concerning the mine they are helping promote, they themselves dream the dream along with the small suckers who swallow the bait. This charitable hypothesis will not always form a cloak ample enough to cover the activities of these hitherto more or less orthodox business men: but it can be used here and there for a partial accounting. When we find that the business man has provided for a partition of the promotion funds, and a sure profit on the stock, even in case the mine does not turn out the wonder which it is going to be, there is evidence of a dual personality, of the hard-headed business man in the background, providing a safe second line of retreat in case the adventuring and confident dreamer should awake to the fact that it was but a dream.

Whatever the psychology, it is evident that crooks are flourishing on the strength of it, on a larger and grander and more highly capitalized scale than ever before. The evidence brought out by the Government attorney against the former Attorney General of the United States (Daugherty) and the former Alien Property Custodian (Miller) in regard to the release of several million dollars worth of securities held by the Alien Property Custodian, for a substantial bribe, appears at first sight at least to be conclusive: and cannot safely be regarded except as a symptom of a tendency which is exhibited in many other places. It is a shameful and disgraceful tendency, at which the nation may well blush; but the various other manifestations are far from having been entirely exposed and held up to public disapproval and punishment. The muck-raker, as Roosevelt called him, is deservedly unpopular; it is easy to have an uncharitable mind and an injurious tongue or pen. Nevertheless, events like this transpire, events like the cases of Fall and Daugherty and Miller—which are typical of a lack of honor and honesty which is exemplified in certain mining promotions and enterprises—concerning which it is incumbent upon all good men to take sides, and declare whether they intend to be for or against such corruption, and do that right vigorously.

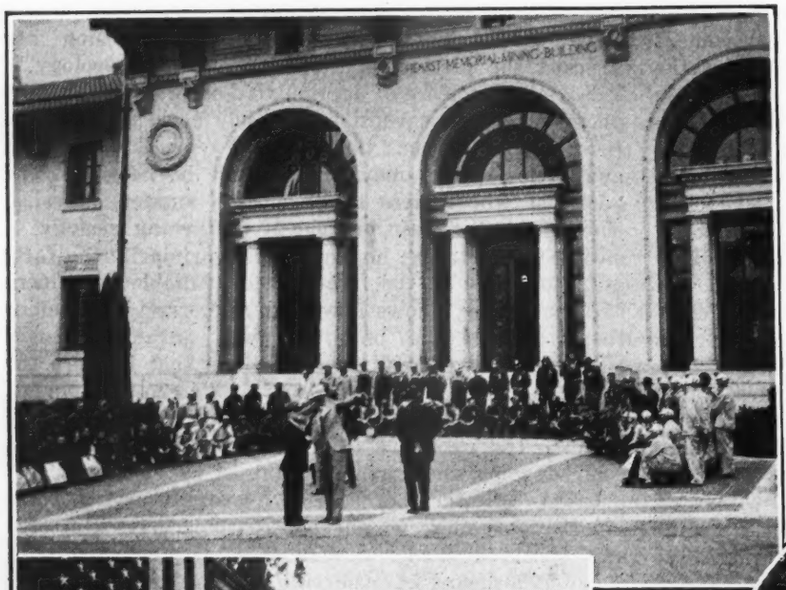
Progress of Science

THE CHEMISTS, speaking at the various meetings and conventions held lately, show a great enthusiasm for the future of their science, and a tendency to become prophets and seers. What has been done only shows them what may be accomplished in the future: they will find chemical substitutes for many if not most of the natural products; they will liberate undreamed-of energy in the course of their reactions and set the machinery of the world going therewith, so that the "mechanical slaves" which now toil untiringly for man and his comfort and luxury, will manifold their activities, and mankind, liberated from labor, will be able to have increased leisure—which he will use in a manner not visualized by the chemists, in the pursuit of culture, war, sport, or the movies. Having burst open the molecule, and analyzed and charted the atom, and formulated the theory that all matter is a form of deadlocked energy, they propose to find ways to transform and transmute, to produce new kinetic energy as the genii arose by rubbing the lamp of Aladdin, and to produce new combinations of matter which will be most useful to man. As one reads their exuberant and daring expressions, one is again reduced to wonder at the deadness and ecclesiasticism and respectable stagnation that characterizes geology, by contrast. With more of this pioneering spirit which the chemists manifest, geology would advance. It is indeed, perhaps, because geologists admire so much these advances in chemistry and physics, because they would hitch the wagon of geology at once to these sciences, that geology does not progress as it should. Physics and chemistry can help, but they cannot solve geological problems. Geology, like astronomy—both dealing with phenomena remote from the surface conditions under which the tests of experimental chemistry are made—cannot be solved in the laboratory: the laboratory of geological experimentation is in the interior of the earth, the reaction and interactions are under varied and immense pressures and operate during vast periods of time; and the indicated way to solve the problems is by studying the results of these "experiments," just begun, half completed, or finished, where some great upheaval and subsequent erosion has exposed the picture to the light of day. Geology is essentially a science of accumulated observation of these phenomena, and careful and closely checked deductive reasoning therefrom; the collateral sciences come in as auxiliaries, which may or may not be helpful. The geologist who strives to become an amateur physical chemist, as the main method of furthering geology, is on the wrong track; he who studies primarily the facts of nature and in the light of all available experience and knowledge, knows how to draw correct conclusions therefrom, is the one who will advance science. Examples of what can be done along that line are the recent papers of Koeberlin and of Prescott, published in *Engineering and Mining Journal;* papers which indicate the existence of great geological laws which some day may be further explained by chemistry and physics. Neither of these investigations included microscopic work, which indeed would have cluttered and obscured them; nevertheless, the microscope is a valuable means of observation, when used with balance and without fanaticism. An example of this is Dr. Schwartz' study of specimens of the ore from the Sullivan mine, British Columbia, in the Sept. 4 issue of *Engineering and Mining Journal.* These observations—which would have been better if accompanied by field studies—disclose the genetic secret of a complex sulphide ore as due to successive depositions at different temperatures, and so aligns the deposit with the recently recognized relatively simple rules of ore-precipitation. Doubtless an inspection of the mine would show on a larger scale examples of the same succession—of galena injected later than sphalerite and pyrrhotite. Most of our ore deposits need to be analyzed in this way, with a due conception of geologic time on the part of the investigator; and it will become increasingly easy to disentangle the factors which make up a given ore deposit and thus to chart in a better and better way ore-creation in general. And this knowledge will develop practical and utilitarian applications as it is disclosed.

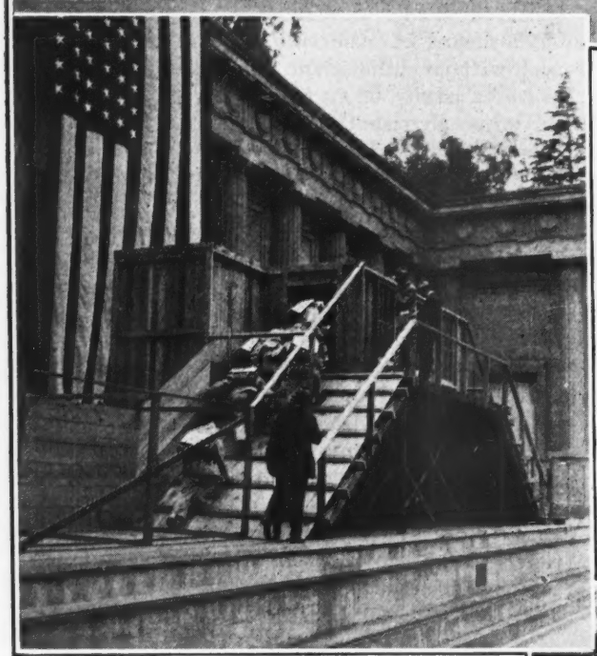
Goggles and the Mining Industries

SEVERAL ENTERPRISING COMPANIES were represented by safety appliance exhibits during the recent Safety Week in San Francisco. Two of them featured goggles. A surprising variety of these useful accessories is now available. Comfort, lightness and suitability for specific purposes mark the goggles now on the market. Eye protection is a factor in many occupations, as eye accidents are by no means uncommon. The mining industries have their problems in this respect. The goggle is not a complete solution but it is an important first-line preventative. Movable and permanent screens answer for certain kinds of work in shops and mills. Eye hazard is involved in chipping, grinding and babbitting in the shop; in welding operations; in hard-rock drilling underground and hammer work generally; tapping blast furnaces, punching converters, in miscellaneous smelter work, and wherever there is flying dust. Safety engineers can serve by investigating the characteristics of the modern industrial goggles and adopting them where appropriate in operations under their charge.

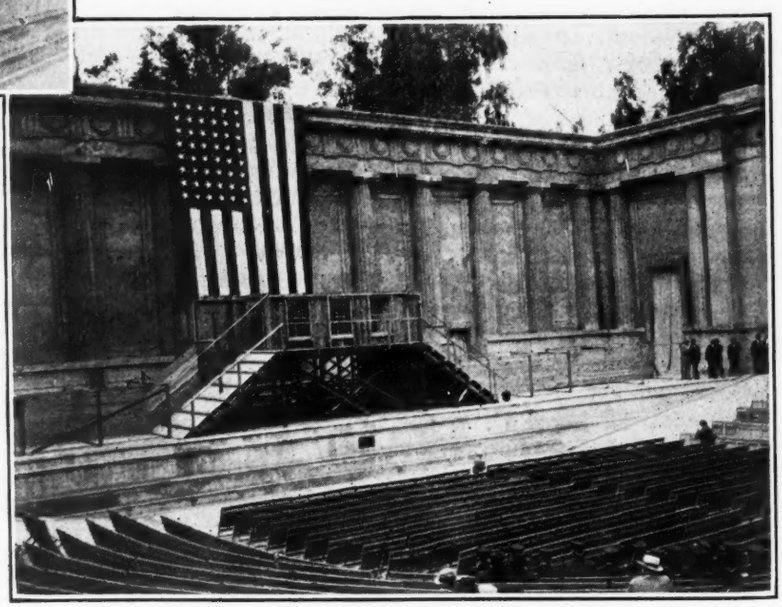
At the Recent First Aid and Mine Rescue Meeting in California



Left—The competing mine-rescue teams assembled in front of the Mining Building, University of California, Berkeley. Below—Preparing a stretcher



Above— Experimental "mine" erected in Greek Theatre at University of California, Berkeley. A mine-rescue team is seen assisting a "victim" up an incline. Right—Another view of the experimental "mine"



Fundamental Hoisting Problems—I

Locating the Shaft; Its Shape and Size—The Headframe —Selecting the Hoist Drum and Rope

By Allan B. Calhoun
Mine Superintendent, Burma Corporation, Ltd., Burma

MOST MINES at some time during their development arrive at a stage when it is possible to decide whether they are going to become big producers or not. If not, work continues on as before, development shafts and winzes becoming operating workings for the extraction of ore, notwithstanding the fact that they were not intended for such work, and an endeavor is made to extract all the ore with the least capital equipment. However, if the development and the preliminary extraction of ore have proved a large orebody which can be mined on a large scale, then one has a big problem to consider as to the most economical means of getting this material to the surface. In most mines, this necessitates good tramming levels and haulage equipment and either an adit or a shaft, with all its hoisting equipment, to bring the ore to the surface, and, as the latter problem is the more complex, I shall confine this paper to this subject.

To install a proper and efficient hoisting plant requires careful planning on the part of the mine superintendent and the assistance and advice of the geologist, mechanical and electrical engineers, and of any other expert who can be obtained. Too often the underground work is done by the mining department without consulting the geologist and other technical experts, and to its sorrow. Shafts have been put in the wrong place and so located that they are later damaged by subsequent subsidence of the workings; or so placed underground, for instance, that the collar is in an inaccessible place; or so situated that elaborate and expensive equipment is required. With proper foresight and knowledge on the part of the superintendent these mistakes can be avoided.

Shafts should not be planned by anyone unless he is conversant with the problem from beginning to end. This requires a careful study of the underground workings, the surface, and the mechanical difficulties involved. The mine superintendent is the man most familiar with these problems and the one most interested in the subsequent operation of the plant. In many places he has not the benefit of expert advice on every matter involved but before he starts work on the shaft or does any planning there are certain fundamentals that he should understand if he is to be able to locate the shaft properly, to determine its size, and intelligently to set forth his specifications for equipment to the manufacturer and to be able to decide as to the merits of the various tenders submitted.

In large organizations, the superintendent's responsibility is divided among several departments, on the chiefs of which he can rely for the solution of problems that come up in each. To one who is so situated or who is close to large manufacturing centers, where experts can be consulted in any line and libraries are available, this paper will likely be of little interest. It is written rather for the engineer in foreign lands, where customs and conditions are different, where the cut-and-dried rules of his home country are not universally accepted, unless first proved superior to those in existence; for the engineer who is far from civilization, and who has to rely on his very limited library and his current technical magazines. To him the many excellent articles written on particular phases of the subject are inaccessible. I propose, therefore, to set forth in this article the fundamentals that a superintendent should know to plan the new plant properly.

In foreign countries, or at mines under foreign control, the superintendent will be guided to some extent by the system in general use, inasmuch as there was generally a reason for its adoption, and because he will find it difficult to persuade a London board of directors or any other to make a change unless ample benefits to be derived from it can be demonstrated.

Locating the Shaft

In the early development stage, small shafts are generally put down in the orebody or close to it, which later are found too expensive to maintain or are not suitably situated for ore extraction. This is to be expected, but when the time arrives to put down a proper working shaft to take care of the remaining life of the mine, sufficient data should have been obtained and considerable study given to the proper location with reference to the following particulars:

1. Proximity to the orebody to be mined and the lateral workings and yet far enough away to be out of the area of all creeps and subsidences due to the subsequent extraction of the orebody. Unless there are other good reasons, this generally places the shaft in the footwall, as a shaft in the hanging generally passes through the orebody in depth and is in the region of creeps and subsidences.

In a mine with soft ground and a large orebody one is surprised at the distance back from the outcrop at which cracks will appear, showing movement. I have seen cracks develop several hundred yards back from the outcrop, so that expensive hoisting plants and shafts had to be abandoned. It is far better to increase the length of tramming underground on the various levels than to run the risk of having to make expensive repairs to the shaft, thus tieing up the work and possibly losing the shaft in the end.

2. Suitable position with reference to the existing surface railway or the contour which will permit its extension.

3. Suitable position, relative to the contour of the country, for erection of hoisting plant and shops that must be built close to the shaft.

Special attention must be given to space available and the distance that the hoist can be placed from the shaft, as this has a great deal to do with the style of headframe and the type of hoist. A big fleet angle will govern the width of the drums and will affect very materially the style and cost of the hoisting equipment.

In flat countries this item can be neglected, as the distance the hoist is placed will be governed by other factors, but in mountainous countries where very little flat ground is available and in underground stations it is an important factor.

4. The shaft (except for very good reasons) should extend to the surface, even if the hoisting is done to an adit level. This allows for a cheaper and better hoisting equipment, and, furthermore, takes the equipment out of a possible damp or dusty mine atmosphere to the surface, where it can be better looked after and where the operator will have the benefit of daylight and sunshine.

In case of fire, with an underground shaft, if it is upcast, the operator is driven from his post and the shaft is put out of use. If it is downcast, it may be necessary to reverse the ventilation, and again the shaft is out of use. An underground hoisting station in a mine where the fire hazard is great is the last resource to be considered in locating an important mine shaft.

5. In a large timbered mine the fire hazard is one of the most important problems, and due consideration must be given to the location of the shaft and to its construction, so that it will not be put out of use by smoke or fire or damaged by the burning of the timbers or subsidence due to the caving of burnt-out stopes. Generally it is better to make the shaft downcast, but since it may be converted into an upcast it should be constructed of fireproof material.

Shaft Should Fit in With Ventilation System

6. The shaft must be located to fit in with the ventilation system, if possible, or otherwise a new arrangement made to make the most efficient use of the shaft.

7. Due consideration must be given to the class of material to be excavated, whether it is sand, soft and hard rock, wet or dry, and whether there are any geological disturbances. Medium hard rock is to be preferred. Faults, with their accompanying water and running ground, are to be avoided. If they cannot be avoided, then careful consideration must be given to the type of shaft and lining.

8. In mines making large quantities of water the position of the shaft is important, as it is desirable to conduct the large volume of water directly to the shaft instead of passing it along the orebody and causing subsequent caves.

9. The lowering and raising of men and getting them to their working faces in the shortest time is another important problem. This is especially so in mines employing thousands of cheap laborers.

10. Construction of the shaft should be such that ample room is left for all pipes and cables, and the lining such that all water is shut off, so that the cables can be kept greased and all equipment painted and maintained in good condition.

It is often the case that the pipes and cables are jammed in some corner where they are difficult to get at and cages and steel girders are rusty from dripping water.

11. The last but not the least consideration is the capital expenditure and the working cost.

Shape and Size of Shafts

In the United States, Canada, and Australia shafts are generally timbered rectangular, whereas in Europe, India, and Africa they are largely brick or masonry and circular or elliptical. In one's own country one generally conforms to custom and does the same as one's neighbors, seldom thinking much about it. I myself had never given much thought to other than the rectangular shaft, but since I have sunk and operated a circular shaft in a foreign country I have come to the conclusion that for certain mines under certain conditions the circular shaft is far more advantageous than the rectangular.

It is true there is less waste space with the rectangular type than others, more particularly the circular, but if the shaft is to be used also for ventilation it is quite probable that the circular will be cheapest and best, especially if the ground is heavy, full of water-courses and faults, and cheap stone or brick can readily be obtained.

A 16-ft. diameter circular shaft has the same area as a 25 x 8 ft. rectangular shaft. The hoisting capacity of a circular shaft to equal that of a rectangular shaft would require 35 to 40 per cent more area. However, if it is acting also as a ventilation shaft it would conduct at least 50 per cent more air, as it gives a steadier flow, with less skin friction, which is less affected by the churning action of the skip and cages as they are hoisted and lowered in the narrow rectangular compartments of the shaft.

Advantages of the Circular Shaft

If a shaft is to last the life of the mine, it will pay to consider well the good points of the circular type. The advantages of the circular, masonry or brick-lined shaft, with steel girders are as follows:

1. It is easier to sink, having no corners to be squared.
2. It is easier to plumb, requiring only one center line.
3. It is watertight. With brick or masonry lining, water can be sealed out and the shaft kept dry. This is not so with a timbered shaft.
4. Lining is cheaper than timber, wherever ordinary, flat, undressed limestone or sandstone can be quarried near by or cheap brick can be obtained and where suitable timber is expensive. Dressed stone cut to a segment of a circle need only be used when large volumes of water under pressure are encountred which would cause the mortar in ordinary rubble masonry to run out. Concrete blocks would most likely be cheaper.
5. It outlasts the life of the mine without repairs.
6. It has sufficient segmental area for ladderways, cables, pipes, and the like without forming additional compartments.
7. The guides of a circular shaft are supported either by channel iron or I-beams. If hoisting is done from one level only, rope guides suspended from the surface are all that is required.
8. There is less dangerous work in sinking a circular shaft, as slips and seams in the strata are never bad and liable to cave in as when parallel to the long side of a rectangular shaft. The rectangular cannot be put parallel to the strata, but must be put across it, as the pressure in moving ground is too great.
9. The circular shaft is much stronger in bad ground.
10. It requires practically no repairs and is fireproof.
11. It is adaptable to the use of big cages which cannot be used in long, narrow shafts.

The advantages of the rectangular timbered shaft are as follows:

1. It has less area for same hoisting capacity.
2. Its stations are all on one side of the shaft, whereas

with the circular type, if there are more than two compartments, stations are on opposite sides or at 90 deg.

3. It can be enlarged by extending the ends, which is impossible with shafts of the circular type.

4. It is more adaptable for the use of timber where water and bad ground are of moderate consideration.

5. It is more suitable for small shafts.

On the other hand, its disadvantages are:

1. The timber is likely to decay and in most mines requires constant repairs.

2. The shaft is liable to take fire.

3. It cannot withstand moving or swelling ground without constant repairs.

4. It is difficult to shut out water, so that equipment is wet and rusted or otherwise eaten up with acid water.

Elliptical Type the Ideal Medium, But Expensive

The elliptical shaft is the ideal happy medium, but laying out the work and keeping the shaft plumb and symmetrical are tasks for experienced miners only and not for inexperienced men or Chinese coolies. Sinking a circular shaft is so simple, however, that Chinese coolies did all the work for me in sinking such a shaft in Burma.

The difficulty of sinking and the extra cost outweigh the extra benefits of the elliptical shaft. The only elliptical shaft that I have observed was the Tennant shaft at the Champion Reef mine, in India. This was one of a few old rectangular shafts remaining in the Kolar gold field. The ground became so heavy on account of the rock blasts (not air blasts) that occurred in the mine that the shaft, which was originally of the rectangular, timbered type, had to be changed into one of the elliptical type with concrete lining. Although all the main shafts in this field are circular, the elliptical type was taken advantage of in order to conform to the area already taken up by the timbers.

Size of Shafts Should Be Liberal

It is advisable to make the shaft liberal in size and to err in the direction of making it too large rather than too small. The extra cost of making the shaft a little large in the first place is small compared to what it would be to enlarge it later on.

The size depends on many factors, but principally on the following:

1. The ultimate tonnage of ore to be hoisted.

2. The ultimate tonnage of supplies and number of men to be lowered and hoisted; also the bulk of these supplies.

3. The ultimate depth of the mine.

4. The method and speed of hoisting.

5. Whether one or more classes of ore are to be hoisted.

6. The volume of air needed for ventilation.

A large mine, hoisting 2,000 tons per twenty-four hours, would possibly require a five-compartment rectangular shaft, say 25 x 8 ft. in dimensions, comprising two skip compartments, two cage compartments, a ladderway and pump compartment, or its equivalent, or a 16-ft. diameter circular shaft with two skip compartments and two corresponding cage compartments or one big cage occupying the space of the two cage compartments and balanced by a counter-weight. The ladder and pump lines would occupy the segmental space formed by the steel dividers.

The large cage has come into more general use recently. It can hold two small ordinary cars or a large timber truck or an electric locomotive. In this way much time is saved, as the timber truck is loaded on the surface, pushed on the cage, and lowered to the required level, where it is pulled off, freeing the cage immediately. With two small cages, supplies have to be unloaded from trucks and stacked in the cage and again from cage to trucks on the underground station, necessitating much extra handling and unnecessary hosting delay.

Skip Hoisting Versus Cage Hoisting

The problem of skip versus cage hoisting must be carefully studied for each individual mine. The great advantages of the skip (low tare and ease and quickness of loading and unloading) are often more than offset by other disadvantages in certain instances. The capital cost is greater owing to the necessity of a higher and stronger headframe (to accommodate the dumping bins) and the underground loading pockets. In the operation of skips, there is great difficulty in lowering and raising men and supplies, and the handling of ore of different grades necessitates separate loading and dumping pockets or other objectionable arrangements. Where cages and cars of large size, with some mechanical arrangement for pushing the cars on and off the cage, can be used, especially in mines with transfer stations or those with different grades of ore that must be kept separate, it is doubtful if the skip has any advantages over the cage. For instance, the management of the City Deep, in South Africa, has decided in favor of cages instead of skips for equipping its new 20-ft. diameter circular shaft, which is 7,000 ft. deep, in two stages of 4,500 ft. and 2,500 ft. respectively, and which has a capacity of 2,000 tons of ore per twenty-four hours besides men and supplies.

The volume of air required to be handled through the City Deep shaft is 300,000 cu. ft. per minute. Cages used are 15 ft. 6 in. x 5 ft. 3 in., with two decks. The lower deck is for ore and the upper for men. The lower deck accommodates one 8-ton bottom-discharge truck or fifty men, making a total of 100 men for both decks. In this particular mine the ore is transferred in cars from one shaft to the other.

In skip hoisting, the size of the ordinary mine car will often govern the size of the skip compartment, as it is common practice to use a combination skip and cage. The capacity of the skip, within certain limits, can be regulated by its length.

Design of the Headframe

It is important that the mine superintendent should understand the mathematical calculations involved in the proper design of the headframe. He should be able to design one, showing the height, the position of the shaft relative to the headframe, and determine the size of sheaves and their spacing and the position of the back leg. It is not necessary for him to calculate the size of the different members, but with this diagrammatic drawing he can send details to manufacturers, or dealers, with other necessary specifications, and have them submit a tender of their own design which conforms to the diagram and specifications. This relieves him of much work and generally gives him several different designs from which to choose.

The type of shaft will determine the style of headframe. For instance, the rectangular shaft could be

provided with a four-post type of headframe with the back leg just outside the resultant force, whereas the circular shaft would require the six-post type of frame. A rectangular shaft with four hoisting compartments in a line would require at least three front legs and three back legs, six in all; that is, the same number of legs that the circular shaft would require for its six-post frame.

The amount of dead weight on the sheaves varies as the included angle the rope makes in going from the hoist over the sheave and down the shaft and varies from 1.41 times the gross load on the rope at 90 deg. to two times the gross load on the rope at 0 deg. The direction of pressure must bisect the angle and this resultant must fall just inside the back leg.

The structure should be simple, made either of I-beams or channel iron battened together with cross-bracing or lacing. The smallest material used should not be less than $\frac{1}{16}$ in. in thickness, on account of corrosion. Structural steel should have an approximate strength of 28 or 32 tons per square inch, an elastic limit of not less than fifteen tons, elongation 26 per cent, and bending test 180 deg. flat on itself without fracture. The headframe should generally be designed with a factor of safety of six on all loads on the ropes and four for dead load and wind pressures, with additional allowance to cover acceleration in winding.

In tropical countries with heavy rains and in countries where there is much snow it is advisable to have the sheaves roofed over and an arrangement overhead for a small crane with which to lift out the sheaves. In the lower part of the headframe between the front and back legs a suitable traveling crane will be of great assistance in handling the heavy skips and cages and loading any heavy material.

The height of the headframe will be determined by the over-all height of the cage or the combined cage and skip plus the clamps and safety hook and the allowance for overwind. This allowance on normal speed is 15 to 20 ft., or approximately two-thirds the circumference of the sheave. For a headframe without skip dumping or with skip dumping below at some adit level, the height of the sheave is roughly 50 ft. If the dumping arrangement is in the headframe this additional height must be added.

Hoist Drums

Types of hoist drums include the cylindrical, the conical, and the cylindrical-conical. Hoisting with a reel and flat rope is also to be considered; likewise the Koepe pulley or Whiting system.

Cylindrical Type. Cylindrical drums with balanced hoisting are the most popular, flexible, and satisfactory for all depths to 3,000 ft. They are of low first cost. With deep shafts where the weight of the winding rope approaches that of the useful load, the torque is very large, and then the remedy is a balanced tail rope equal to the hoisting rope, which gives a torque equal to the useful load, or a different type of drum. The objection to the tail rope is the increased weight in the system and the swing and serge of the rope. The tail-rope system, further, is not good for hoisting from several levels, as the cages cannot be moved independently when desired.

Cylindrical drums are narrow, allowing the hoist to be installed much closer to the headframe, and, if need be, the rope can be wound upon itself. However, it is better to make the drum larger in diameter and wider so as to take a single layer of rope.

Conical Type. Conical drums are adapted to deep shafts and heavy loads when hoisting from the bottom of the shaft where it is desired to keep down the peak loads. The advantage of balancing is often offset by their costly and difficult construction and inflexibility. They are not good for hoisting from intermediate levels and must be designed for a specific load and depth of shaft. Their great advantage is in starting the load on the small diameter while the descending load is on the large diameter of the drum. This advantage is not as great as one would suppose, because a certain amount of it is offset by the greater inertia of the drum.

The drums are heavy, generally wide and of large diameter, and grooved to take the rope. Since the rope cannot pass the center, as in a cylindrical conical drum, the drum must be large in diameter and wide, and to keep the fleet angle within reasonable limits the hoist must often be placed at a great distance from the shaft. In hoisting from different levels it is difficult to spot cages, as the ropes are on different diameters of the drum, resulting in much loss of time.

The drum must be large enough to take the entire rope on one layer and the smallest diameter must not be less than the bending stress of the rope will allow. The drum must have a large amount of space on the surface.

Use of the conical drum reduces the size of the motor on the initial load and has good balancing effect. The drum takes a greater torque to start and accelerate than the light cylindrical drums. It is rarely used now and has been supplanted by the cylindrical-conical drum in depths of 3,000 ft. and over.

Cylindrical-Conical Drums Preferred to Conical

Cylindrical-Conical Type. Drums of the cylindrical-conical type are generally used in deep shafts where the hoisting is done from the bottom of the mine. They are not suitable for intermediate levels, as their benefits are lost by increased inertia. It is very difficult to deck cages, as the two cages travel different distances for the same revolution of the drum, requiring extra manipulation and loss of time. They are preferable to conical drums, as they are of lighter construction, and the rope can be wound closer and past the center on the other side of the cylinder. They have all the advantages of the conical drum. They are generally of built-up steel construction.

Theoretically, cylindrical-conical drums are good, but in actual practice they often do not justify the extra additional expenditure. It is very difficult to start a load on the full diameter of the drum. This type of drum has the same advantage over the conical drum that the cylindrical type has over the latter.

Reels. The use of reels with flat rope affords excellent balance with all the advantages of the conical drum. A drum or reel of small diameter can be used with this type of rope. The reel is light and the inertia small, so that a smaller motor is required. However, a flat rope wears out quickly, costs more, and is heavier than a round rope. The capping is difficult and the stitching breaks and has to be restitched about once a year.

The big advantage of the reel is that it needs but small space and consequently can be placed close to the shaft as there is no fleet angle. The reel has almost disappeared in England, Europe, and the United States.

Koepe Pulley. The Koepe system calls for a large

friction pulley in place of the drum. The rope from the top of one cage passes over the sheave and around the Koepe pulley and over the other sheave to the second cage, with a tail rope attached to both cages. This system is still used in Europe and is efficient, requiring small space. The pulley replaces the drum and permits a small fleet angle and has small inertia.

The Koepe pulley has following disadvantages:

1. The rope has a tendency to slip.
2. The rope cannot be greased.
3. It is difficult to recap the rope.
4. If the rope breaks, both cages fall, but this seldom happens, as the rope will slip first.
5. The system is unsuitable for mines where hoisting is done from different levels, as the cages cannot be handled independently.

Whiting System. The Whiting system is a modification of the Koepe system in that a tightening pulley or movable carriage is added to facilitate operation from different levels. It is used in the deep mines of South Africa and in the Michigan copper country, but is not popular. In the reconstruction of the devastated collieries in France, the French engineers replaced the Koepe system by the cylindrical-conical drum.

Ropes

Careful consideration must be given to the selection of the proper type and size of hoisting ropes, as these materially affect the size of the drum and the subsequent cost of the plant. Too small a rope is dangerous and too large a rope, with its increased weight and reduced flexibility, is costly in rope and plant and may not wear as long as a smaller one. It is therefore much better to plan the original layout, taking in consideration the rope, as it is easier to choose a rope to fit ideal conditions than to try to fit it afterward into some cramped or exacting conditions. Due consideration must also be given to the future, and not only the immediate need. Often the future work to be done is so great that the speed has to be increased to such an extent that undue fatigue takes place and the rope lasts only a few months instead of a year or more.

The best and most serviceable hoisting ropes are generally made from plough steel of three grades, as follows:

Grade of rope	Tensile Strength Tons per Square Inch
Ordinary	95 to 100
Best	100 to 110
Extra	110 to 120

Although plough steel costs about 10 per cent more, it is considerably stronger and is strongly recommended for deep shafts.

The principal data that must be ascertained before making a choice of rope are as follows:

1. Diameter and length of rope.
2. Diameter of drum and sheave.
3. Cylindrical or conical drum, wood-lined or not, grooved or plain.
4. Maximum load, including rope.
5. Speed of hoisting.
6. Condition of shaft, bad water, upcast or downcast.
7. When facing shaft, is the upper rope on the right- or left-hand side of the drum?
8. Is the hoist to be operated by an electric motor or by steam?

The diameter of the rope depends principally on the gross load and the factor of safety. The latter is the quotient obtained by dividing the breaking strength of the rope by the gross weight of the rope and load when the cage or skip is at the bottom of the mine. This factor is different in various countries and varies from a maximum of 10 for men and 7 for ore to as low as 7 for men and 4 for ore in some of the deep mines. In deep shafts the spring of the rope tends to eliminate the shocks of starting and acceleration. The factor can be slightly lowered when using an electric motor, as there is an absence of the pulsation inherent in the reciprocating engine.

All other factors remaining constant, the factor should vary as the depth, as follows:

Depth of Shaft	Factor of Safety for Ore
500 ft. or less	8
500 to 1,000 ft.	7
1,000 to 2,000 ft.	6
2,000 ft. and over	5

The diameter of sheave and drum should be as small as possible, consistent with the diameter of the rope; that is, 1,000 to 1,200 times the diameter of largest wire in rope or about sixty times the diameter of rope. By selecting a rope of high breaking strength, a smaller rope and consequently a smaller sheave and drum and cheaper plant can be installed. When using a conical drum, the rope must be small enough in diameter to wind around the smallest diameter of the drum without undue bending stresses.

The Fleet Angle

Where the rope winds in layers on a cylindrical drum, the fleet angle should not be over 1—70 and the limiting angle at which it will return satisfactorily on itself is 1—50. For a drum with a greater fleet angle than this, the face should be grooved.

High-speed hoisting causes undue wear and tear on the rope and is to be avoided when possible.

The condition of the shaft should be determined, as it is important to know whether the rope is likely to be abraded by the sides (timber or masonry) or will come in contact with acid water and gases from dynamite or smoldering mine fires.

With the foregoing data in his possession, it will be possible for a manufacturer to select a rope to fit conditions. The superintendent may then choose from the offers of the various tenders. Several types will be offered, as in various countries different types have been used, and the opinion that the type adopted is best for local conditions is entirely natural.

Types of Hoisting Ropes

The principal types of hoisting ropes are the following, and each has its particular points of superiority under certain conditions: Ordinary lay; Lang lay; flattened-strand Lang lay; and locked coil.

Ordinary Lay. This is the type used most generally in the United States, although in latter years it is gradually being replaced by Lang lay at a number of mines. It consists of strands twisted in opposite direction to that of wires comprising the strand. Its advantage lies in its elasticity and therefore resistance to shocks, but this is offset very materially in its short life compared to that of some other ropes. The wear is taken on one wire of each strand, and this wire must be worn down before adjacent wires take any wear. When the wire breaks, it sticks out lies across the adjacent wire, causing it to break also. The common type for

hoisting has 6 strands 19 wires around a core of hemp.

Lang Lay. This make of rope is used almost exclusively in England and South Africa, India, and Australia, and its use is increasing in the United States. It consists of wires twisted in same direction as the strands. It is smoother than ordinary lay and resists wear much better and does not wear the sheaves like the former. Lang lay is stronger, and when the sheave and drum are of proper size, it is more satisfactory than ordinary lay.

The old form of Lang lay had a tendency to untwist and this caused trouble where the rope was wound in layers on the drum by loosening up the strands and causing internal friction. There is very little twisting now in a properly designed hoisting rope, and the Lang lay is now being made into a non-spinning rope. However, swivels should not be used, and, when the rope winds upon itself in more than one layer, a scroll piece should be fastened to the drum to permit the rope to rise from one layer to the next without undue friction.

To avoid excessive wear, the proper hand lay should be used. A rope passing under the drum from the left to right should be a left-handed rope and the rope over the drum from left to right a right-handed lay. This tends to tighten up the strands, and any friction is sliding instead of sawing action.

Flattened Strand Lang Lay. This lay has six groups of wires, each with a wire of triangular cross-section in its center or a group of small wires in the form of a triangular surrounding a core of hemp. There are generally twenty-five to thirty wires in a strand. It is smoother than Lang lay but not so smooth as locked-coil. It is 12½ per cent stronger than ordinary round-strand wire rope and is rapidly replacing the ordinary strand Lang lay in mines of ordinary depths. It is not so flexible as ordinary Lang lay, but is less liable to twist. The wear on outside wires is quite uniform.

LOCKED-COIL ROPE FOR HEAVY HOISTING IN DEEP SHAFTS

Locked Coil. Locked-coil rope has a central wire core surrounded by a series of round and specially shaped wires locked together—layers of round wires in one direction and layers of formed strands in the opposite direction, rendering the rope non-spinning. The exterior surface is smooth, and wear by friction is minimized. The wear on the wires is uniform, and when a wire does break it is held in position. This rope as originally made was not considered suitable for hoisting but it has since become a favorite in many deep shafts with heavy loads. It is 44 per cent stronger than round-strand rope size for size; 16½ per cent less in size and 2 per cent lighter than a rope of equal strength. As this rope is sealed with an anti-corrosive lubricant during its construction it is almost entirely free from internal corrosion.

Locked-coil rope requires a drum of larger diameter for the same size of rope than do other types, but its great advantage lies in its smaller diameter for equal strength, permitting narrow drums to be used in deep shafts and so keeping the fleet angle within reasonable limits and at the same time decreasing the size of the drum and thereby lessening the inertia and peak load. This decrease in drum width and inertia will often result in a saving of 10 per cent in the cost of the hoisting plant.

To be concluded

How to Equip a First Aid Room

Suggestions Based on Recent Recommendations of Authorities and Official Regulations, as Well as Practical Experience

First aid rooms are an integral part of most large industrial establishments and in small plants they can also aid production as well as employees. The general factors to be considered in organizing a first aid station in a small plant are: (1) Extent and character of service likely to be rendered; (2) type and training of person to be in charge; and (3) location, size, and equipment of room.

As a general rule, if the accident rate is high and a plant contains no doctor, nurse, or dispensary, a considerable reduction in the cost of accidents can be demonstrated by a first aid station in charge of a well-trained nurse, according to "First Aid Rooms in Small Plants," a booklet just issued by the Metropolitan Life Insurance Co. If a trained nurse is not to be in charge of first aid work, the attendant should be well trained in the principles of first aid by a competent authority. Persons doing first aid work not under the immediate direction of a doctor must scrupulously avoid any attempt to clean up serious wounds, set fractured bones, remove foreign bodies from any part of injured person if embedded (particularly from the eye) or administer any drugs except in an urgent emergency.

One hundred or two hundred square feet should be planned for a first aid room. It should be centrally located and placed so as to insure quiet, comfort, and privacy. The room should be heated and have light and ventilation from outside windows, as well as good artificial light. The best interior finish is tile or plain white or gray paint, and the floors should be of some impervious material that can be easily washed. Running water is essential.

Simple equipment helps to avoid mistakes in treatment and aids in the upkeep. A flat firm couch, a cover, two dark blankets, a pillow provided with a rubber cover, a white metal or painted wooden table for dressings, two chairs, drinking water with paper cups, a covered waste pail, and two enamel basins complete the furnishings for a room where no elaborate treatment is expected to be undertaken.

The first-aid kit or cabinet should be of the simplest type and contain the following: Tincture of iodine and applicators or iodine in individual ampules; bandages and sterile dressings, including finger dressings—1½-in. compresses, 3-in. compresses, a few large 4 x 6-in. compresses, and a few bandages of various widths; a tourniquet; aromatic spirits of ammonia; and adhesive tape and safety pins.

In addition to the supplies, scissors, towels and pure soap are all that is necessary. An accurate record should be kept and followed up to make sure that subsequent satisfactory care is obtained.

"First Aid Rooms in Small Plants," based on recent recommendations by authorities, regulations by State departments of labor, safety associations, and practical experiences of many plants, has just been released by the Policyholders' Service Bureau of the Metropolitan Life Insurance Co. It is the first pamphlet of a series on industrial hygiene. Copies may be had without any charge by writing direct to the Policyholders' Service Bureau, Metropolitan Life Insurance Co., Madison Square, New York City.

Successive Banding Around Rock Fragments in Veins*

By J. E. Spurr

THE TEXTURE of many mineral veins is homogeneous, indicating simultaneous crystallization. Some of these have formed by replacement, some by infilling into fissures. Both classes may contain

Fig. 1—Photograph of specimen of "orbicular" vein. Alacran mine, Zacualpan, Mexico. Width of specimen 6 inches

portions of the wall rock: in the replacement vein these are residua of replacement; in the infilled or fissure veins and veindikes they are fragments which have become involved in the ore solution when it was so dense that these fragments could be supported.

From the type of fissure veins which show homogeneous crystallization there is a gradation to veins which show more or less distinctly a progressive crystallization, resulting in a faint or clear banding growing out from the walls. This structure is not an evidence of deposition by waters coursing through a fissure. It is entirely compatible with deposition from a highly concentrated ore solution standing quietly in a fissure and crystallizing leisurely.

In such banded veins we find in many cases suspended fragments of the wall rock; and we may find these fragments surrounded by the same successive rings as those deposited on the walls. Such a structure is not only compatible with crystallization from a dense static ore-solution, but affords a better proof of this origin than the homogeneous veins, since the first ring around the isolated fragments defines their shapes at the beginning of crystallization. The suspicion that these fragments may be residua of replacement is thus excluded.

As an example, I have studied fragments of a vein sent me from the Alacrán mines, in Zacualpan, Mexico. I have to thank Mr. Paul X. Stoffel for sending me the original specimen and calling attention to the structure, and Señor Ing. Luis C. Espinosa, mining geologist and engineer, of Mexico City, who has supplied me with descriptions and additional material. The ores of these mines are silver ores, carrying the rich silver sulphides, sulpharsenides, and sulphantimonides: these minerals are ordinarily associated with sulphides of lead, zinc, copper, and iron. There is some gold.

The veins are described by Mr. Espinosa as "true fissure veins," with a principally quartz gangue, in altered sedimentary rocks much metamorphosed by intrusives. In width they vary from a centimeter to a meter and a half. The veins are typically banded. In certain extensive zones the bands are parallel and symmetrical to the walls; in other zones, the veins contain included fragments, around which is concentric banding; so that the veins have been aptly called "orbicular veins."

Figure 1 is a photograph of a specimen of an orbicular vein, showing apparently the entire width of the vein, 6 in. I have thought it worth while to draw accurately the successive stages of crystallization, in order to follow the history. The inclusions are of slaty or altered shaly rock, very likely a tuff, and the slaty lamination is oriented differently in different fragments, and differs as between the fragments and the walls, which are of the same rock. This, of course, proves by itself that the fragments are not residua of replacement, even though they are rounded, rather than angular. Also, these fragments contain veinlets of an older barren ("bull") quartz, antedating the opening of the fissures; and the successive bands to be presently described build upon the broken edges of this quartz.

The first deposit on the fragments was a brown mineral (2, Fig. 2). The hand lens shows a sharp contact between this and the slaty fragments (1, Fig. 2). The band is usually over a tenth of an inch in thickness around the fragments; but it occurs on the walls only as a thin skin, although all the subsequent rings are about equally thick on the walls and around the frag-

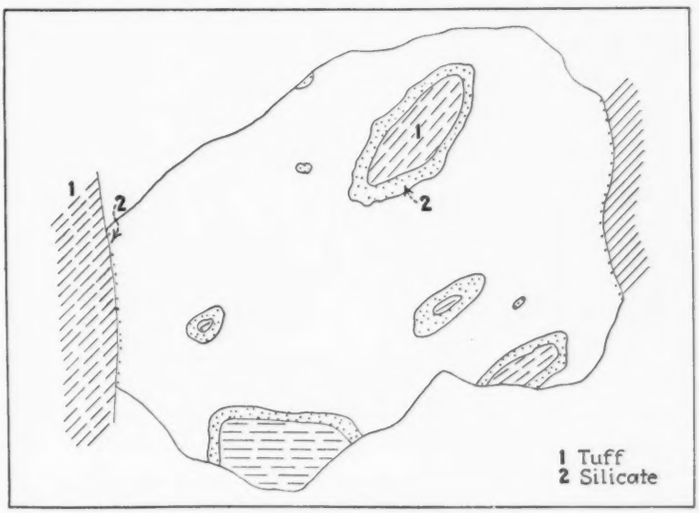


Fig. 2—Analysis of Fig. 1, showing first stage of deposit in vein

*Paper read at the meeting of the Society of Economic Geologists, May, 1925, and published in *Economic Geology*, September, 1926. Republished by permission. Some additional data have been added.

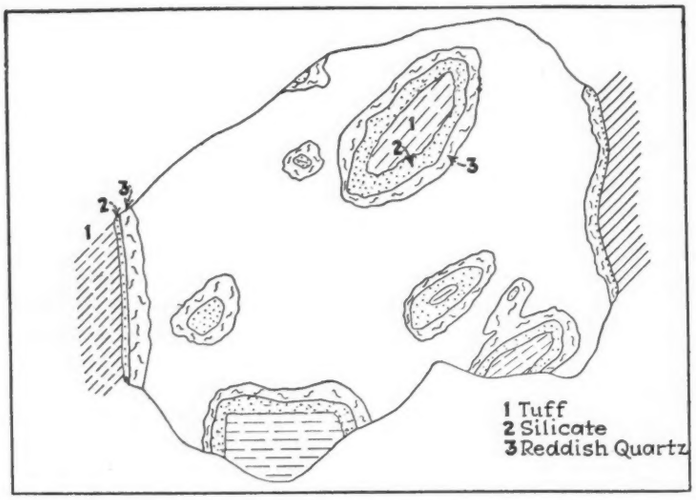


Fig. 3—Analysis of Fig. 1, showing second stage of deposition in vein

ments. This brown mineral has been determined by Prof. J. Volney Lewis as a hydrous silicate of lime, ferric iron, and manganese, apparently a new mineral. I take it that this silicate, like most silicates, represents a relatively high temperature in the ore solution; also, that its failure to deposit on the walls indicates that the fragments migrated in the magma to their present position after the silicate deposition. Moreover, on the obverse side of the specimen photographed, one side of one of the fragments shows the silicate band practically missing, with only the barest film, such as the wall rock shows.

Next came a band of reddish quartz (3), which formed with equal thickness around the fragments and on the walls, with a thickness of about $\frac{3}{20}$ to $\frac{5}{20}$ inch (Fig. 3). This quartz cemented together a larger fragment and a smaller one in the lower right-hand part of the drawing.

Next came the deposition of a black band of silver sulphide (4), deposited uniformly around floating fragments and on walls. This had a thickness of about $\frac{1}{20}$ of an inch (Fig. 4).

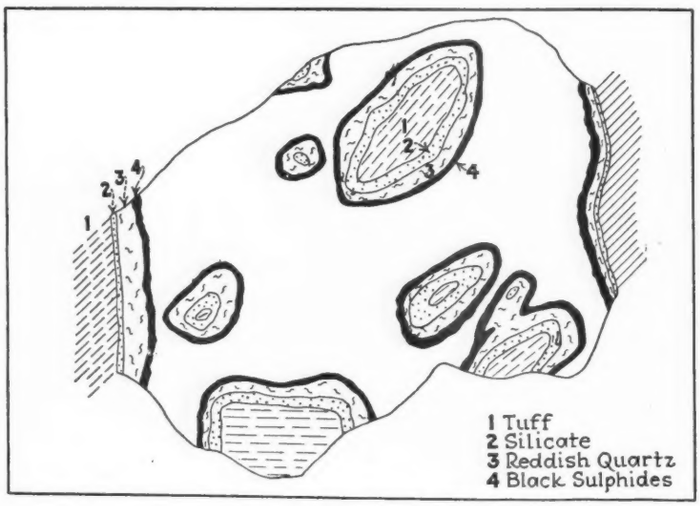


Fig. 4—Analysis of Fig. 1, showing third stage of deposition in vein

Next came a band of gray quartz (5) on walls and fragments alike, and about $\frac{3}{20}$ of an inch thick. This deposition for the first time cemented some of the fragments to the wall rock; it also cemented pairs of neighboring fragments together (Fig. 5).

Next came a pyrite band some $\frac{2}{20}$ of an inch thick (6), which reduced still further the open space (Fig. 6).

The remaining space was now filled with white quartz (7), which grew out in long crystals from the nodules shown in Fig. 6, into the open spaces, resulting in comb structure. This, together with the other phenomena, shows a gradual deposition from the walls and fragments outward. Not only is the origin of the fragments by replacement excluded, but also the origin of the banding by Liesegang's rings, which are successive contemporaneous rythmic bands which have been formed experimentally in gels. The bands in the Zacualpan vein were not contemporaneous, but represent six

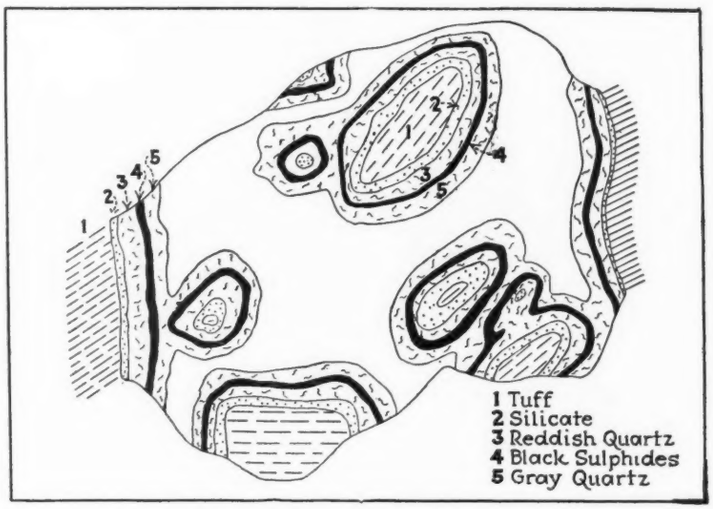


Fig. 5—Analysis of Fig. 1, showing fourth stage of deposition in vein

successive precipitations out of a solution. These precipitations, to recapitulate, were: silicate (lime-iron-manganese); silica; silver sulphides; silica; pyrite; silica. This suggests a precipitation out of a single solution, with falling temperature. But this solution must have been able to float the fragments, for they were clearly separated from one another and from the wall rock at first, and only became connected through the growth of deposition bands; it must therefore either have been so highly concentrated that it had a higher specific gravity than the specimens; or (which other instances render far more likely) the solution was in a physical condition which gave it supporting power.

Another specimen from the same vein shows interesting variations. Photographs of the two sides of this are shown in Figs. 7 and 8; explanatory drawings in Figs. 9 and 10. The first brown silicate stage (2) is far more abundant than in the first specimen (Fig. 1), and is divisible into two successive stages—an apparently amorphous stage (2-a) and a later clearly fibrous and banded stage (2-b). See Fig. 9. There is in

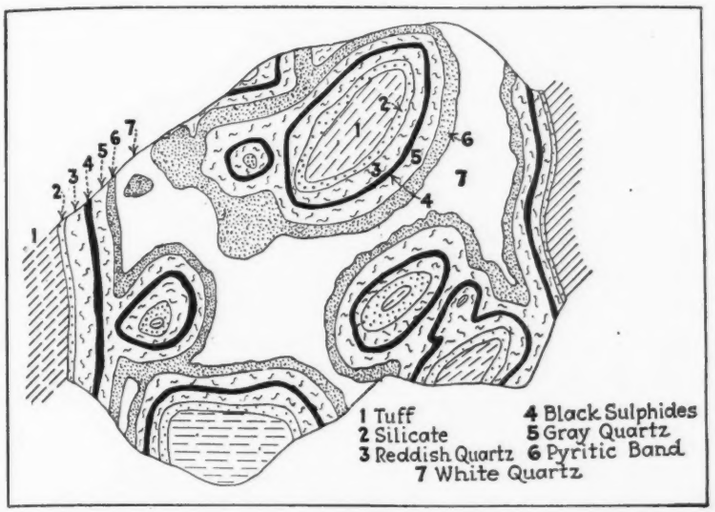


Fig. 6—Analysis of Fig. 1, showing fifth and sixth (last) stage of deposition in vein

this second specimen clearer evidence than in the first that even 2-a was not formed by replacement, for it builds upon the earlier "bull" quartz (1-a) in the slaty fragments (1), and contains slivers of slate differently oriented. There was, moreover, movement and some spalling off of the fragments between 2-a and 2-b, shown in some cases (Fig. 9). This process continued after the 2-b deposition, as is clearly shown in some fragments (Fig. 10). Moreover, further spalling took place after the deposition of the quartz band (3), so that the sulphide band (4) was locally deposited directly upon the slate surface (Fig. 10). Again, this spalling process continued after the deposition of (4), as is strikingly shown in more than one instance (Fig. 10). The subsequent quartz band (5) completed the cementation of the open spaces in this specimen: hence (6) and (7) are not represented, this final ore-magma fraction having been drawn off into the still open parts of the vein, such as represented in the first specimen (Fig. 1). Open vugs, lined with quartz, chalcedony, and a green tabular mineral, mark the final disappearance of the solution.

Those who have seen the photograph of a specimen from the Colorado tin vein, in Bolivia, in Mr. Koeberlin's paper on Bolivian twin veins in the issue of *Engineering and Mining Journal-Press* of April 17, must have been struck by the general similarity of structure between the Bolivian tin-vein specimen and that from the "orbicular" vein of Zacualpan described above. Indeed, the Bolivia specimen shows a genuine orbicular vein, with successive ringed deposition around isolated fragments in the vein matter (Fig. 11). There is no doubt that this structure is a common one in veins, but one which has not been sufficiently and thoughtfully studied.

It is to be noted of the Colorado tin vein, in Bolivia, that the walls at one end are of slate and at the other of porphyry, according to Mr. Koeberlin; but included vein fragments of either rock may be found next to the walls of the other. This relation of included fragments to walls shows that the former cannot have been brought into their present position by faulting; while the diversely oriented slate fragments as well as the progressive ringed deposition around them show that the fragments cannot have been the residua of replacement. The only answer to the problem is that the ore fluid (ore magma) picked up these fragments and carried them along to their present position. As at present exposed in the photographed polished face the fragments do not touch, and study of the successive rings fails to show that they ever did. The inference is that the fragments were supported by the ore magma, and for a relatively considerable period of time, during which the many bands of vein matter were deposited.

The splitting up of the fragments during the process of deposition, so striking in the

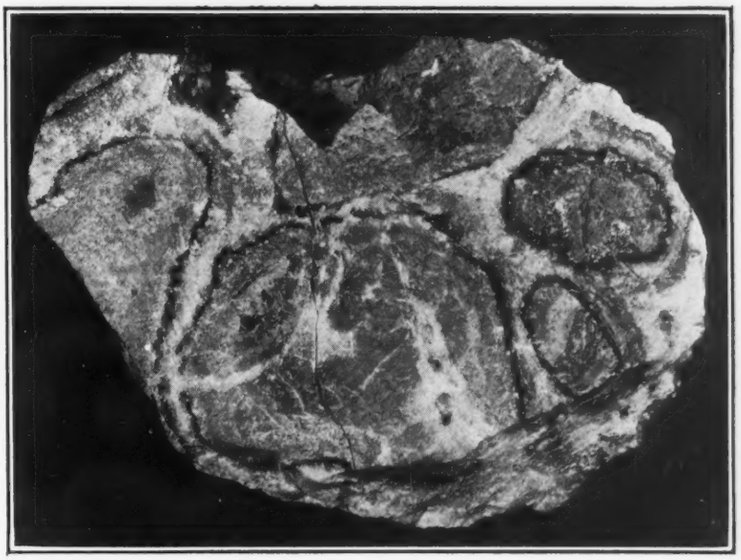


Fig. 8—Converse side of same specimen as Fig. 7

Fig. 7—Photograph of second specimen of "orbicular" vein, Alacran mine, Zacualpan, Mexico. Width of specimen about 6 inches

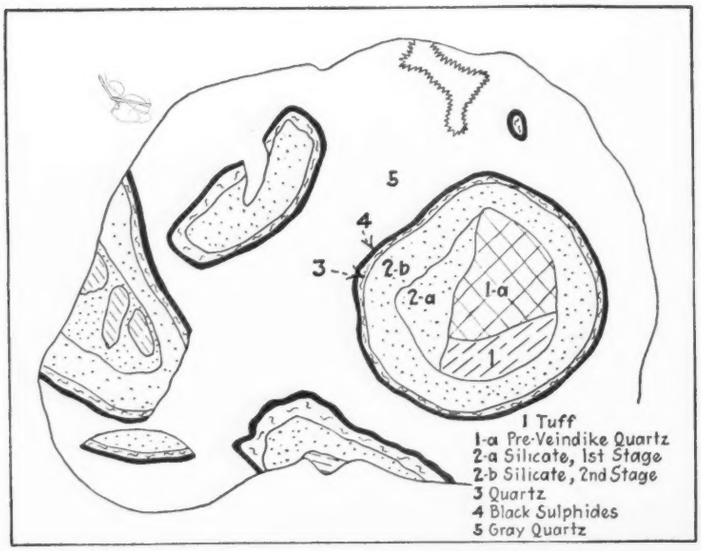


Fig. 9—Analytical drawing of Fig. 7

"orbicles" together fast. And last of all are the central vugs, representing the residual gaseous portion of the ore magma.

The rings show a so-to-speak rhythmic deposition, there being in the early stages of precipitation repeated alternations of quartz and cassiterite. For such fine rhythmic banding the explanation of "Liesegang's rings" is always suggested; but these are a different type of phenomena. Leisegang's rings form all at one time in a gelatinous substance; whereas here the repeated spalling proves that the banding was successively ring upon ring, and therefore from a fluid.

It may further be deduced that the period of crystallization from the fluid ore magma was relatively long, for rapid crystallization would not yield this ringed or orbicular structure, but the interlocking crystalline structure characteristic of many infilled fissure veins. And it is further deducible that this leisurely crystallization meant static relatively high temperature; and that this meant that the temperature of the wall rocks was the same as that of the ore magma when the ore magma was injected.

Such a specimen as this is so full of instructive data that I have undertaken to write out an approximate chronology of events which it shows—most of which can be verified from a careful study of the photograph.

A. Fragments of country rock, differently oriented, never in contact with one another, showing effects of silicification and pyritization.

B. Finely banded brown cassiterite and quartz, about $\frac{1}{8}$ inch—growing out from A.

C. Spalling of fragments, and much migration of spalled pieces, so that they usually cannot be matched in the section.

D. Black cassiterite, about $\frac{1}{16}$ inch, building rims on fragments.

E. During and after the deposition of D, renewed spalling of frgaments, and much migra-

Zacualpan silver vein, is almost equally so in the Colorado tin vein. This splitting took place at different periods, as study of the individual fragments will show; it is not divisible into certain definite events, as if it were due to dynamic movement, as along a fault fissure; but shows a continuing or static condition which permitted or caused it. As is well shown by one of the smaller fragments in the lower part of the photograph of the Colorado vein specimen, this splitting in some cases was without much displacement, while at others the subsequent movement was great. The phenomena correspond to the explanation of "spalling" of fragments immersed and isolated in a hot fluid. At a certain stage, however, this spalling and moving about ceased; and thereafter the bands of deposition are regular, showing that the progress of cementation by successive deposition of layers had finally stuck the growing

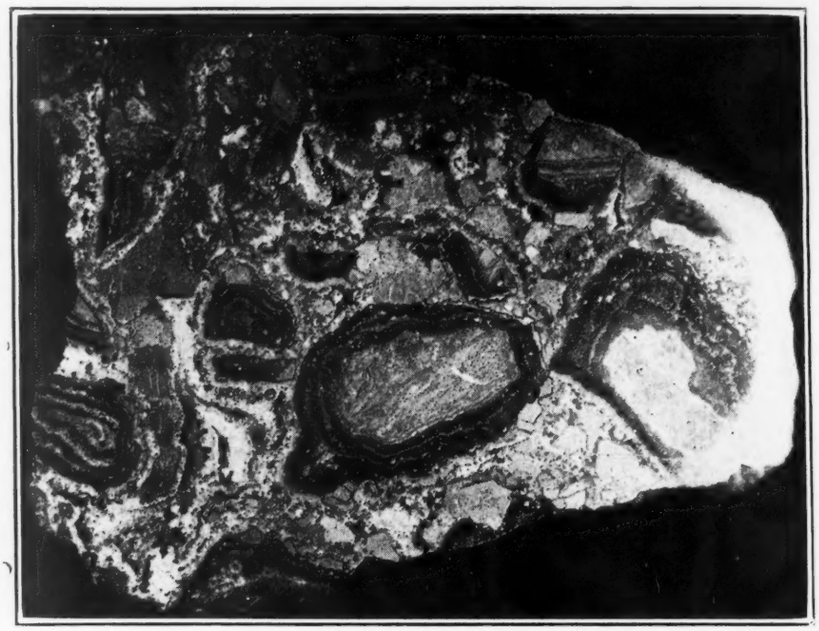


Fig. 11—Hand specimen Colorado vein, Chocaya, Bolivia

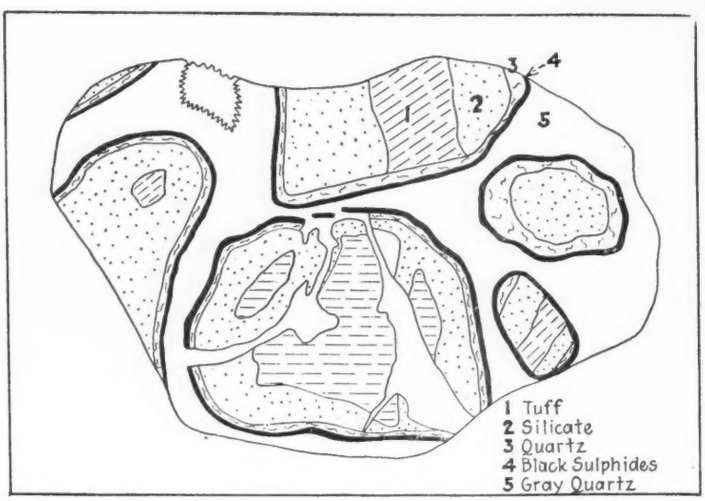


Fig. 10—Analytical drawing of Fig. 8

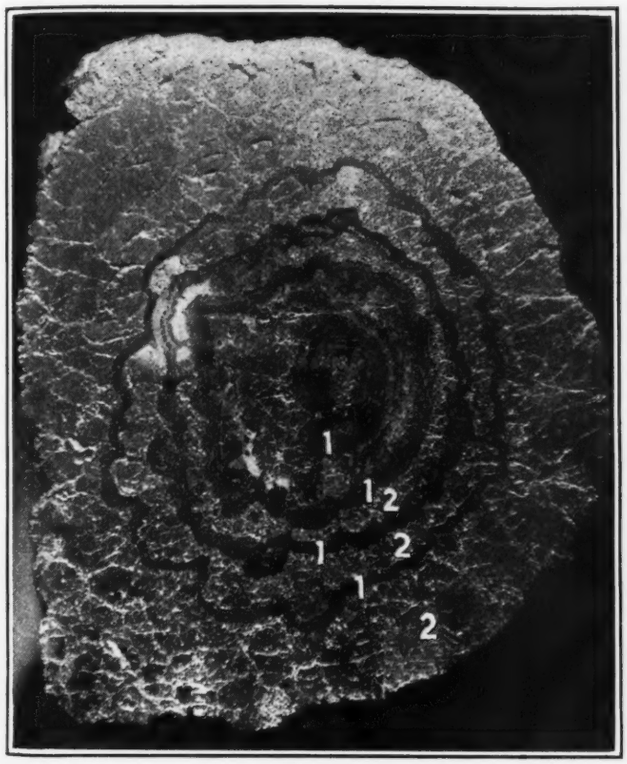


Fig. 12—Hand specimen from Colorado vein, Chocaya

Isolated fragment showing small nucleus surrounded by alternate bands of cassiterite and pyrite. 1, Cassiterite with small amount of quartz. 2, Pyrite. Twice natural size.

tion of spalled pieces, so that in most cases they cannot be matched.

F. Pyrite, quartz, and some brown cassiterite bands, building up on the broken fragments, and terminating in small druses lined with a green coating (which also coats an occasional small crack). The pyrite differs from all the other mineral constituents in being only rudely banded—it occurs in large crystals and chains of crystals also. It appears to have replaced to some extent earlier consolidated material: and also to have formed large floating crystals on which subsequent fine quartz bands have been molded. Nevertheless, this quartz has partially corroded, split, and embayed these pyrite crystals. The pyrite is not a universal deposition, as are all the other elements, but irregular in distribution, as well as in crystal growth, as above.

The photograph of a small specimen from this same Colorado vein[2] given by Mr. Koeberlin shows apparently the rhythmic alternation of deposition of cassiterite and pyrite four times, as follows: Cassiterite, pyrite, cassiterite, pyrite, cassiterite, pyrite, cassiterite, pyrite (Fig. 12).

Fig. 14—Photograph of sawed surface of zinc ore from Mascot mine, Tennessee, showing toothed "collar" of dolomite crystals around fragments of dolomite rock. Diameter of specimen about three inches

Phenomena of this same order, although not so striking, are common. For example, at the zinc mines at Mascot, in Tennessee, the ores occur in Paleozoic dolomite, and the primary ore is almost exclusively yellow blende, with a dolomite-calcite gangue. The ore occurs in a brecciated zone. Wilbur A. Nelson, former state geologist,[3] says:

"It occurs in the brecciated horizon as veinlets, irregular masses of variable size, fracture fillings, and breccia cement. Gangue minerals occurring with the sphalerite are dolomite and calcite. The quantity of sphalerite is variable, generally being greater in the more intensely brecciated rock. . . . The ore does not occur continuously along the strike of the rocks in the zone just above the contact between the Canadian and Ozarkian, but occurs in shoots irregularly spaced. These oreshoots vary from 100 to 200 ft. in width and are an intensely brecciated zone varying from 25 to 120 ft. in thickness. The ore in these brecciated shoots varies in richness, containing from 1 to 5 per cent metallic zinc.

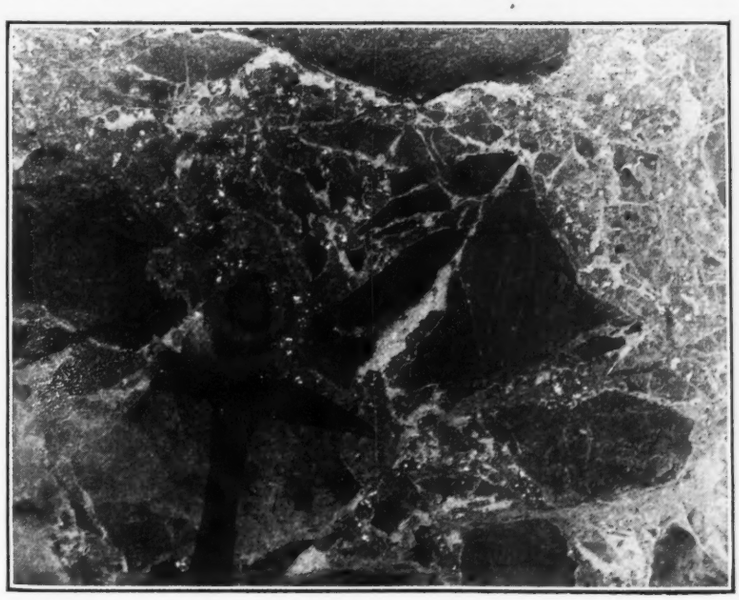


Fig. 13—Photograph of zinc ore in stope, at Mascot mine, Tennessee. Ore cements a dolomite breccia

[2] *Engineering and Mining Journal-Press*, April 17, 1926, p. 641.

[3] *Trans*, A.I.M.E., Birmingham meeting, October, 1924: "Mascot, Tenn., Zinc Ores," pp. 7, 8.

These shoots are irregular, tortuous, and more or less connected. Their distribution is irregular."

Mark H. Secrist[4] says: "As has been repeatedly stated, the ore is associated with brecciated horizons in the country rock. The origin of the brecciation is not at all times clear, particularly when no visible planes or movement can be seen. On the other hand, at the Felknor mine, the Fall Branch mine, New

Fig. 15—Photograph of slab of "grande antique" marble at Hotel Roosevelt, New York. Height of slab about 8 feet

Prospect, etc., direct evidence of brecciation associated with faulting is at hand. The breccia is usually made up of sharp-angled fragments of the country rock cemented by a matrix, which consists of variable amounts of white or gray dolomite, some calcite, chert, sphalerite, galena, and pyrite. It should be mentioned that galena is found only in a few districts and is not a widespread constituent of the breccia filling."

I went underground in October, 1924, and collected specimens which I shall describe. I noted that "nearly all the ore is in fissure fillings, occurring in many small veins of white dolomite which reticulate the gray dolomite of the ore horizon sharply. This dolomite incloses blende. In many instances there is a definite fine banding (crustification) of these veinlets. These veins join to form large ore masses, inclosing angular broken blocks of white or gray dolomite." (Fig. 13). Later I studied the specimens, including one with a sawed surface given me by Mr. Blair, of Birmingham (Fig. 14), and perceived that all the specimens showed a definite successive crystallization, from the included fragments out. The fragments are also of different types of dolomite—different in color and in texture, and with different orientation, showing that they represent pieces mixed together, not residua of replacement. In some cases these fragments touch; but rarely. They are invariably surrounded by an envelope of bluish-gray carbonate, probably dolomite, about one-eighth of an inch thick (Fig. 14). The outer margin of this envelope shows a continuous line of well-developed crystal faces, showing that these crystals grew out into a fluid (the alternative of open spaces being negatived by the almost invariable separation of the fragments one from another). The rest of the interspaces is occupied by practically contemporaneous pinkish dolomite and yellow blende. In some places the blende, in others the pinkish carbonate, is molded on to the toothed collar which surrounds the rock fragments. There is, however, evidence of a delicate succession of crystallization within the blende itself; for the light-yellow blende,

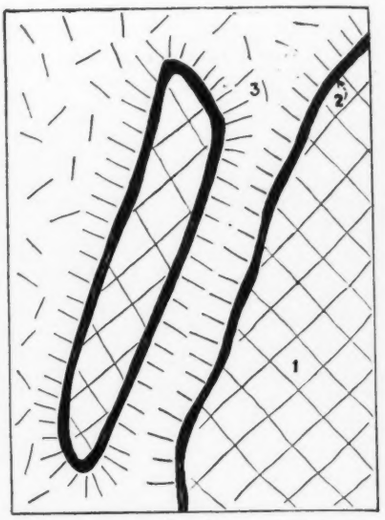


Fig. 16—Analytical sketch of portion of specimen of silver-lead ore from Villemagne mine in France

Diameter of field sketched about two inches. 1, silicified limestone (jasperoid) largely replaced by blende and galena (pyrite); 2, galena; 3, comb quartz, near the broken fragments of (1), developing into granular quartz away from the fragments.

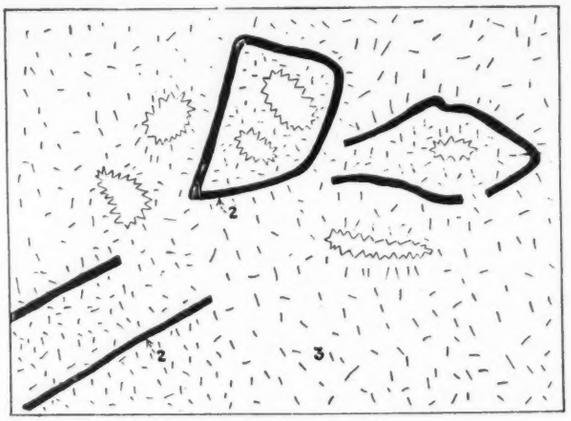


Fig. 17—Analytical detail of portion of another specimen of same ore as Fig. 16. Diameter of field sketched about three inches

Shows (2) typical galena rims of fragments; (3) crystalline quartz, containing geodes. (3) has not only disrupted but has entirely replaced the original limestone angular fragments on which (2) was moulded, although it has not attacked noticeably the jasperoid and sulphide fragments shown in Fig. 16. The quartz which has replaced the fragments is, as indicated, finer grained than the quartz between the fragments.

[4]Cited by Nelson. *Trans.* A.I.M.E., Birmingham meeting, October, 1924: "Mascot, Tenn., Zinc Ores," p. 10.

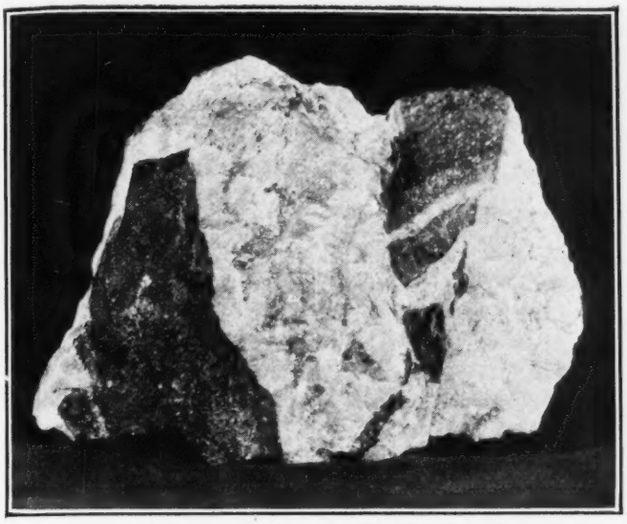


Fig. 18—Photograph of specimen from one of the silver-bearing veins of Cobalt, Ontario. Width of specimen, three inches

free from iron, has a distinct tendency to border the fragments, outside of the carbonate spiked collar, while slightly darker blende occupies the centers. There is no sharp line between these two shades of blende, however, showing that the two are parts of a single crystallization stage. (Tiny veins of white carbonate cut all the foregoing.)

In this connection deserves mention the "grande antique marble," used for decorative finish in buildings, and said to come from Jeumont, France. I am trying to obtain geological descriptions of this occurrence. Meanwhile, the polished slabs on the outside of the Hotel Roosevelt, in New York, extending around the whole block, form a magnificent geological exhibit (Fig. 15). The decorative effect is due to blocks of black bituminous (locally fossiliferous) limestone inclosed in an abundant white matrix. The polishing reveals a definite and universal though delicate banding of the matrix, hardly noticeable on the rough fracture; and the banding is molded on to the included fragments, showing that crystallization began on those surfaces. The first deposition is an opaque white dolomite, in which fine parallel banding may be detected; and in residual areas left by the growing together of this dolomite is colorless calcite, as determined by Prof. J. Volney Lewis.

I believe nearly anyone who will walk around this block and study the exhibit carefully will conclude that these limestone fragments have been suspended and isolated in a solution which was capable of supporting them—the white cementing material was not deposited from circulating waters, but was the result of crystallization, *in situ*, of a highly concentrated solution. Yet this solution was, when it burst into the black limestone, a clear solution: all crystallization succeeded emplacement, and there are even no signs of flow structure. In this "grande antique" stone the process of continued splitting up of the black limestone fragments into smaller fragments may be observed in all stages, and the word which seems most descriptive of this is *spalling*. It seems that the cementing solution, penetrating into crevices, had an expanding and a prying power.

The specimens which I have described show almost exclusively phenomena of injection, and show little important evidence of replacement. Specimens which have been sent to me by Mr. H. H. Knox, from Villemagne, a silver-lead-zinc mine in the south of France, show evidence of injection and successive crystallization, and also of replacement by the injected fluids. The history of these specimens I interpret as follows:

A. Partial replacement of a dense, dark, shaly limestone by pyrite, blende, and galena. (1, Fig. 16.)

B. Shattering of the ore and rock by the injection of a siliceous vein magma. Inclusion of ore and rock in angular detached floating fragments.

C. Deposition of galena (2, Fig. 16) from the fluid magma, in rims around the included fragments. (The galena is presumably argentiferous.) This stage shows that the crystallization of galena was in general later than that of blende, so that the sequence indicates falling temperature.

D. Movements within the vein magma, separating the angular fragments into new fragments, so that some of these have the galena band on one margin but not on the others.

E. Crystallization of quartz, as a growing fringe or halo, with comb or toothed structure, crystal terminations pointed outward. Growth of this shows in fine banding of the quartz, the different toothed layers of quartz crystals having built one upon the other (3, Fig. 16).

F. Further partial fragmentation, involving all of the foregoing and due to the injection of more quartz, and barite.

One of the specimens shows the entire inside of the angular included fragments (everything except the galena collar) eaten out and the space partly taken up by little druses lined by quartz crystals. The fragments on which the collar grew is entirely gone (Fig. 17).

Referring back to the "orbicular vein" of Zacualpan, I wish to quote an observation by Mr. S. J. Truscott, who, among other professional work, has translated into English the "Ore Deposits" of Beyschlag, Vogt, and Krusch. (Macmillan, 1914.) The subjoined passage was a part of a discussion of the paper by Hatchek and Simon on "Gels in Relation to Ore Deposition."[5]

"Mr. S. J. Truscott said that he had had occasion at one time to be working on a mine where there was a considerable amount of banded quartz. The reef belonged to the Tertiary gold-silver orebodies, an important group. Towards the hanging wall the ore was richest, and there the banding was very close, resulting in the formation of a dark-colored leader; on either side of this the banding became more open. Towards the footwall, however, there was a different occurrence; here there was an arrangement of the banding concentric to rounded or subangular fragments of the country rock. This ore they generally spoke of as *ringel-erz*, the German term for one of that description. He understood the authors to say that the banding was the result of a reaction proceeding from the walls and therefore parallel to them. This would, however, not account for the concentric banding. Perhaps the authors, however, could apply their reasoning to produce not only the parallel but also the concentric banding. With regard to these fragments in the footwall, it was rare that in any section there was sufficient evidence that without their quartz envelopes they support one another by touching. Originally, before they were thus enveloped, how were they supported in the fracture? It has been suggested that actual contact between the fragments did actually take place more than the evidence would lead one to suppose, but that the growth of the envelopes caused in some

[5] *Trans.* Inst. Min. and Metal., 1911-12, pp. 473-474.

cases a separation, the fragments having been forced apart. It appeared to him that that might be true with the smaller fragments but not with the larger. It could be more easily imagined that they were supported by the silica in a gelatinous condition. He supposed the ordinary idea was that these crusts were gradually formed as film after film was slowly deposited. There was, however, no reason to accept the gradual filling of a fracture as the only possible occurrence. In the lavas which have poured out from Vesuvius it has been recorded that large fractures became filled with mineral deposits in a short time. As in all these Tertiary gold-silver reefs, where the filling was chiefly of silica, *the formation of the reefs* marked the last stages of *a dying vulcanicity;* it is quite possible that they *were also formed quickly, so quickly as to provide a support for the fragments in the fractures.*

"The fact that gelatinous silica contained so much water, together with the assumption as a speculation that the reefs were first filled with this silica, might offer an explanation of the vugs so often found with these reefs—viz., that the silica in becoming desiccated shrunk to leave a central space."

In this paper I have cited instances where breccias appear to have been formed by the injection of a concentrated and dense solution, capable of holding for a considerable period fragments of the invaded rock in suspension. In all the cases I have mentioned there has been a successive precipitation around these fragments from the inclosing fluid, these bands demonstrating that the isolated fragments were the nuclei outward from which crystallization progressed, and were not the centers toward which crystallization proceeded—in other words, that they were not residua of replacement. I have carefully refrained from discussing the origin of the dense solution in this paper, my purpose being to show that the work of water is much exaggerated in orthodox geologic conceptions. Neither are these bands to be explained as contemporaneous with one another, according to the theory of vein banding advocated by Hatchek and Simon,[6] based upon the phenomenon of the Liesegang rings due to chemical reactions in gels or colloids. The phenomena show the bands are due to a succession of crystallization; and in two of the specimens described I have detected evidence of falling temperature during crystallization.

In closing I wish to show the photograph (Fig. 18) of a specimen from a vein at Cobalt, Ont. The white filling of the Cobalt veins appears to be homogeneous and without evidence of concentric growth around included fragments; so that the origin of the fragments as residua of replacement has been argued. On observing, however, that the fine banding in the "grande antique" stone was clear only on a polished surface, I examined my rough specimens of Cobalt veins attentively, and did indeed detect faint banding parallel to some of the fragments, which on polished surfaces might be plainer. In the photograph (Fig. 18) a regular band of calcite about ⅜ of an inch thick around the wall rock inclusions, is free from metallic minerals; outside of which rim, however, the metallic minerals occur mingled with similar calcite.

Spanish Production of Mercury Greater

The Government-owned mercury mine at Almaden, Spain, recently issued its statement for the fiscal year 1924-25, according to U. S. Consul, A. W. Ferrin, showing extraction during the period of 19,491 metric tons of mineral, yielding 35,530 flasks of mercury of 34.507 kg. each, an increase of 10,479 tons over the year before.

[6] "Gels in Relation to Ore Deposition," *Trans.* Inst. Min. and Met., 1911-12, pp. 451-480.

Legendary Diamond Mines of Brazil

Story Dates Back More Than 200 Years—Official Records Contain Substantiating Data

By Charles N. Lurie
966 Trinity Ave., New York, N. Y.

SOMEWHERE in the deep "hinterland" of Brazil, that has been but little explored by white man, there are, according to tradition, rich, unexploited diamond and silver mines. This tradition is of fairly respectable age, having passed from generation to generation for more than two hundred years.

The ancient story is to the effect that one Melchior Diaz Moribecha, a Brazilian, born in Sao Paulo about 1689, found the mines. He was of half-breed Portuguese and Indian ancestry, and he worked in his early manhood as a miner, a hunter, and a vaquero (cowboy). Moribecha was of a restless, roving disposition, and he drifted from job to job and ranch to ranch, on what was then the western border of Brazil. He heard, probably from wandering Indians or half-breeds, the old tales of rich mines of precious metals and gems that were to be found in the unexplored interior of Brazil, and determined to try his own luck in the "hinterland." The accounts given to him—with much embroidery, probably—of wild peoples, cannibals and others, did not deter him from entering the wilderness, and he made many hunting, exploring, and prospecting trips.

During one of these trips, according to the story, he found exceedingly rich silver and diamond mines in the district of Jacobina (about 200 miles from the coast), and also a silver mine in the Sierra de Boraccio. But he had neither the means nor the equipment to work the mines, so he drifted back to civilization—or what then passed for civilization in Brazil, a Portuguese possession in the wild South American continent in the first half of the eighteenth century—where there was strong drink to be had, and he probably babbled when in his cups. Whereupon the authorities heard of his alleged discoveries, and approached him with a view to the exploitation of the mines.

Moribecha was shrewd, and he knew of the unfair and even harsh treatment of the discoverers of mines, by the government. He put little faith in the lavish promises of the officials, and refused obstinately to reveal to them the location of his mines. They were his by right of discovery in the little-known and unmapped regions. He intended to reap for himself the full value of his labors, despite the colonial laws that decreed that a certain percentage of all minerals found in the provinces must go to the state.

Jail Treatment Fails

But he paid a bitter and heavy price, no less than his liberty and, eventually, his life, for his contumacy and his defiance of the authorities. They resolved to force his secret from him, so they arrested him and confined him in the jail in Bahia. There, for five long years, Moribecha lived amid great deprivations of air, light, and food, the while he refused obstinately to divulge his secret to the avaricious, inquisitorial officials. They visited him often, and argued with him, and even menaced him with instant death unless he spoke. Eventually, the restrictions of this terrible prison wore out his life, but not his obduracy. He died with his secret undivulged. Schooling of a sort this half-breed vaquero

and miner must have had, for in his prison cell he composed some recollections, in which he deplores his misfortunes; they are inserted in Acciole's "Historical and Political Memoirs of the Province of Bahia." So far goes the legend, or tradition. As for fact, it is known that the "lost mines of Moribecha" have never been rediscovered.

Official Records Bear Out Story

Diligent investigation by the highest authorities of Bahia, at my request, shows that in a mixture of legend, tradition, and conjecture concerning Moribecha there are some facts. Dr. Berardino Jose de Souza, the "Secretario Perpetuo" (permanent secretary) of the Instituto Geographico e Historico da Bahia, Brazil, says in a report to me that the name Melchior Dias Moribeca (not "Moribecha," as it is given in Appleton's "Cyclopedia of American Biography") should be Melchior Dias Moreya. "The latter," says Dr. de Souza, "is the real name of the explorer, of the end of the sixteenth century and the beginning of the seventeenth, to whom is attributed the discovery of the silver mines that have become legendary. Those mines, better known as 'the mines of Roberio Dias,' who was the son of Moreya and an Indian woman, have not been located up to now."

Moreya was not, according to the Institute, a native of Sao Paulo, but of Bahia; he was a member of an expedition that set out for the conquest of the district of Sergipe. He settled on the banks of the River Real (about 100 miles from the coast), where he became a hunter, and also acquired many head of cattle. But he was a born hunter, explorer, and prospector, and he wandered far afield from his ranch to explore the wild parts of the province, especially in search of precious minerals. Eight years he spent in quest of mines and then, about the year 1618, the government heard of his activities and his reputed success. (It should be noted that Dr. de Souza definitely "dates" the ranchman-miner about a century before the birth of the legend or tradition.) Moreya offered to tell the location of the silver mines which he declared he had found. In return, there were made to him promises of titles of nobility, grants of land, the position of superintendent of the mines, and other favors.

Explorations were made along the route indicated by Moreya, but they all came to nothing. Probably he was "foxy," and distrusted the officials. It is known that the royal government (Brazil was then a dependency of the crown of Portugal) expended much money in the efforts to find the mines. But Moreya died at the age of eighty, in 1622, without ever having led the government parties to the ores.

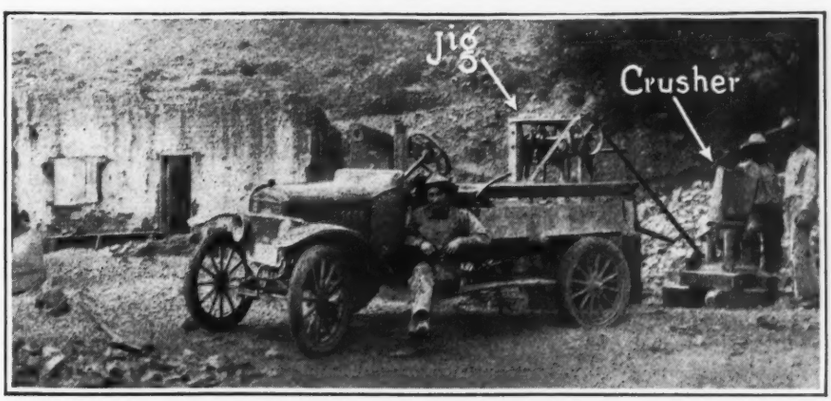
"Around this story the popular fancy built the legend of the 'Roberio Dias mines,' in which even the real name of the explorer was changed to that of his son," says Dr. de Souza. "It was Sebastiao da Rocha Pitta, author of the 'Historia da America Portugueza,' who first brought out this legend from tradition, and spread it without further scrutiny or criticism. The investigations of the illustrious Professor Capistrano de Abreu, however, threw light on the subject, reducing the legend to its true proportions."

However it may be as to the "true proportions" of the legend, it is certain that a belief in the existence of the "lost mines" persisted in Brazil for many years after the death of Moreya. In 1671-1675 the Portuguese Governor of Bahia, Affonso Furtado de Mendonca Castro, Viscount of Barbacena, sent out an expedition under Melchior da Fonseca Saraiva Dias Moreya (nicknamed "Moribeca"—hence the "Moribecha" of the story), to find again the silver mines said to have been discovered by his great grandfather Moreya. But again the search was in vain; 'Moribeca' went no further than the headwaters of the River Real, where he gathered a few stones containing white pyrite. The disappointment and disgust of Barbacena were great.

Since that time, it seems, nothing of moment has been done to find the "lost mines of Roberio Dias." But the legend persists.

The tales of the imprisonment of *someone* for refusing to divulge the whereabouts of the mines confuse Moreya, his half-Indian son, and his great-grandson, in the manner that is so frequently exasperating to historians and archivists. Just how much truth there is in the tales it is impossible at this late date to ascertain with exactness. It seems likely that it was Roberio Dias, the son of Moreya and the Indian woman, who was incarcerated. Dr. de Souza writes: "The legends of the imprisonment center around the person of Roberio, and not of 'Moribeca.' According to what is known, Roberio had not his father's genius, and did not follow his lead, being always indifferent to his labors."

The diamond mines are, of course, a later addition to the legend, comparatively speaking; Brazil was not regarded as a great diamond-producing country until 1727, when the diamonds were first noticed. Before that time the natives of Brazil used the precious stones as "chips," or counters, in certain card games.



A novel milling plant near Santa Barbara, Chihuahua. The truck furnishes the power

Detonators and Tests for Them

THE utility of high explosives in industry is dependent upon the employment of some means of exploding or detonating the explosive which will convert its latent energy into useful work, secure every unit of power it contains, and protect the person releasing the energy, writes Charles S. Hurter, technical representative of E. I. du Pont de Nemours & Co., in one of the company's service bulletins. In practice, high explosives are detonoted by means of an intermediate agent that will produce a violent impulse embodying both shock and heat.

What happens when the detonator in a high explosive charge is fired is, according to Berthelot, something like this: The heat applied to the explosive compound in the detonator by the spark of the fuse, or by the electric current, starts a process of chemical decomposition which transforms the solid compound into a much greater volume of gases and liberates a considerable amount of heat. The rapidly expanding heated gases, bursting from their confinement in the copper shell of the detonator, strike the charge a blow which is converted into intense heat at the point of shock and sets up chemical decomposition in the first layers of the explosive charge surrounding the detonator. This chemical decomposition, in turn, generates new heat and gases which exert their shock upon the next layers of the explosive, raising them to a high temperature and producing still further decomposition, so that a sort of explosive wave travels swiftly through the entire mass and transforms it into a volume of highly heated gas expanding and exerting such tremendous pressure that it bursts from the bore hole in a final explosion and dislodges or shatters the confining rock, its energy thus converted into useful work.

The amount of this work, the execution secured from a given quantity of any given explosive, is determined very largely by the mode of its detonation. The detonator itself becomes, therefore, of such importance as to deserve further study.

Now, the action which takes place between a detonator and the charge which it fires depends, in the first place, on the strength of the initial pressures exerted by the detonator, on the suddenness of their development, and on their distribution; and, in the second place, on the relative stability of the compounds which make up the explosive in the charge, as this determines the ease with which chemical decomposition can be started and the explosive wave transmitted to the remainder of the mass. In other words, the action depends on the amount of energy transformed into heat in a given time in the first layers of the explosive affected by the detonator. Two of the governing factors—the suddenness of the shock imparted by the detonator and the amount of work it is capable of performing (that is, the amount of heat it is capable of generating—vary with the explosive substance in the detonator, and the relative degree in which each of these factors will be produced by ignition of the substance must be taken into consideration in selecting this substance. In general, the most effective detonating compound will be that which unites the quickest shock with the highest temperature.

The purpose of detonators is to fire high explosives loaded in a bore hole, and the only true and reliable test of their efficiency is to use them for this purpose and observe the results. Various tests have been devised, however, which have a considerable value if their limitations are properly understood. Some of the detonator manufacturers make up special insensitive explosives for testing detonators. Firing equal charges of explosives of varying degrees of insensitiveness, under identical conditions, with different types of detonators is a fair indication of the relative strength of the detonators, but there are numerous tests not involving the actual detonation of any dynamite, which indicate the *condition* of the detonator tests rather than afford any accurate comparison between different kinds or different makes of detonators. As a matter of fact, the detonators can be varied in shape and make up so as to improve the results obtained in these various tests without increasing their efficiency in detonating high explosives and, in some cases, the modifications may even reduce their ability to produce perfect detonation.

One of the simplest of the tests for detonators is the lead-plate test. It is made by centering a 1½ in. square cut from 10-lb. sheet lead (about $\frac{5}{32}$ of an inch in thickness) on the end of a short piece of 1¼-in. iron pipe in a special holder, placing a blasting cap, or an electric blasting cap, on the lead plate so that its end is held by the holder firmly and squarely on the plate, and firing the cap in the usual manner. This lead plate is then examined for two results of the explosion, one of penetration and the other of radiating lines on the plate called "sunburst effect." The test indicates the comparative condition of caps of a single kind and make but not of caps of different kinds or makes. Any method of concentrating the charge will increase the penetration effect. Thus, an increase in the diameter of the copper shell which concentrates the charge closer to the lead plate results in much better penetration, but as shown previously in discussing the effect of diameter of the charge on the initial impulse imparted, this same concentration, if carried to extremes, lowers the efficiency of a blasting cap when it is used to detonate high explosives.

Again, the reduction of the percentage of chlorate of potash in the detonator charge gives a more concentrated load because of the high specific gravity of fulminate of mercury and results in a better plate test in spite of the fact that the 80-20 mixture is considered to be more efficient in the detonation of high explosives than the 90-10, the 95-5, or straight fulminate.

And, again, a cap with an indented end gives a better lead plate test than one with a flat end, and one with a flat end a much better test than one with a convex end, although these variations in shape do not alter the efficiency of the cap as a detonator.

The simplest test of the U. S. Bureau of Mines (Technical Paper 125, "The Sand Test for Determining the Strength of Detonators"), consists in measuring the shattering effect of detonators in quartz sand. One hundred grams of sand screened through a 20-mesh sieve and caught on a 40-mesh sieve are placed in a special container. The detonator is exploded in the center of this mass, and the shattering effect on the sand is then determined. In this test a long detonator with a small diameter will give a better result than one having a larger diameter and concentrated charge, on account of the greater amount of sand in close proximity to the explosive charge in the former.

Another test is known as the Trauzl block test, from the name of its originator. Into a lead block of given weight a hole is bored of a diameter just large enough to admit the blasting cap. The cap is exploded and the volume of the resulting cavity in the lead block is measured as a good indication of the strength of the detonator.

Still another test consists in exploding a cap on a plunger in a special apparatus, under certain standard conditions. This plunger acts on a thin sheet of copper below it, and the capacity of the resulting "dish" is taken as indicative of the strength of the detonator. In fact, nearly every detonator manufacturer has a special test of his own in which his detonator gives better results than any other. All these tests are useful in their way so long as they are never allowed to obscure the fact that the efficiency of detonators consists in their ability to detonate high explosives.

Cananea Smelter Improves Reverberatory Practice

Elimination of Roasting or Drying the Concentrate Charge Increases Recoveries and Cuts Costs

By A. D. Wilkinson
Smelter Superintendent, Cananea, Sonora, Mexico

THE PRACTICE of smelting the entire charge in the reverberatory furnaces without roasting or drying has now been in operation for a year at the Cananea smelter of the Cananea Consolidated Copper Co., S. A., and sufficient data obtained to justify the statement that, under the operating conditions at Cananea, such a procedure is successful and economical.

The smelting plant consists of twelve roasters, two reverberatory furnaces, eight blast furnaces, and six converters; with a small crushing plant capable of reducing the reverberatory charge to a maximum of ⅜ in., and three mixing and storage beds operated on the Messiter system. Prior to the use of differential flotation at the Cananea concentrator, the smelting plant had been operated at a maximum capacity at different periods.

The operation of differential flotation on Cananea sulphide ores resulted in a material reduction of concentrate tonnage, and an increase in the copper content of the concentrates from about 4½ to 17 per cent copper. A change in the physical character of the concentrates was also effected, the colloid content being reduced so that the concentrates were drier and capable of being handled through bins and chutes as readily as fine ore. The effect of this change at the smelter was a lower smelting cost per pound of copper and increased recovery due to a smaller tonnage of slag and fewer metallurgical units in operation, only six roasters, one reverberatory, and two converters being necessary.

The roaster plant was not equipped with a positive dust collecting sustem, having only a dust chamber large enough to secure low velocity of the gas flow. This, though adequate for comparatively coarse low-grade feed, was inadequate for the collection of dust from the differential flotation concentrates. Various attempts were made to avoid this heavy loss. By reason of the low sulphur content of the roaster feed, it was possible to force the tonnage to be roasted through three roasters instead of six, care being taken to keep the amount of excess air at a minimum. This improved conditions, but the stack loss was still too high. The concentrates were then taken out of the roaster feed and charged wet to the reverberatory. This caused an unsatisfactory feed to the roasters and an unbalanced charge to the reverberatory, with unsatisfactory results. An attempt was then made to partially dry the entire charge in the roasters, which resulted in the sulphides melting out in the reverberatories, leaving a highly siliceous material that fused slowly and soon choked the furnace.

It was then decided to smelt the entire charge without roasting or drying. This was found to reduce the capacity of the reverberatory furnace about 50 per cent, but the results were so satisfactory that another reverberatory was started up to take care of the tonnage, and the roaster plant operation discontinued. The following gives the major items of interest in connection with the present Cananea smelting practice:

1. An increased recovery of 9.4 lb. of copper was made per ton of dry new material treated, of the analysis given below.
2. The cost of installation and operation of a mechanical dust-catching system is saved, with a much greater recovery than such a system could give.
3. The reduction in copper losses comes from eliminating roaster stack losses, eliminating dust losses from handling and charging the hot fine calcine and dust, and from the lower copper content of the slag.
4. The effect of the moisture content of the charge in the reverberatory is to facilitate the elimination of sulphur—probably by retarding the melting of the sulphides, although there may be some reaction at the high temperatures of the smelting zone. The moisture also tends to eliminate dusting inside the furnace, thus reducing the fluxing action on the silica brick and the amount of dust carried out to the flues and boilers and on out the reverberatory stack.
5. Better advantage can be taken of the heat from the burning of oil and oxidation of elements of the charge itself than when the roasters are operated.

The new material in the reverberatory charge carries 10.6 per cent moisture and its analysis is 8.71 per cent Cu; 18.3 S; 25.2 SiO_2; 8.4 Al_2O_3; 20.9 Fe; and 1.8 per cent CaO. It has amounted to 91.88 per cent of the dry solid charge, the balance being cold converter slag shells. The molten converter slag poured back into the reverberatories has been 30.71 per cent of the solid charge. About 10 per cent of the new material received for treatment is utilized as silica for converter flux.

The matte has run 22.45 per cent copper, and the analysis of the slag has averaged 0.25 per cent Cu.; 40.1 SiO_2; 12.4 Al_2O_3; 35.8 FeO; and 2.5 per cent CaO.

The gross ratio of barrels of oil per dry ton of solid charge has been 1.17. Of the sulphur charged, 37.54 per cent was eliminated in the reverberatory. The copper recovery was raised by 5.70 per cent and the silver by 4.25 per cent.

Discussion

Favors American Dredges and Engineers

THE EDITOR:

Sir:—The latter part of your London Letter in your July 17 issue contains the interesting explanation of the procedure of the Dome Mining Corporation, Ltd., of London. This company, it seems, equipped its dredging property in Spain some time ago with a Netherlands type of dredge, and now, after many months of serious effort, it is found the dredge is entirely too light to handle the material successfully, and, moreover, the depth to bedrock does not seem to have been properly determined even at this date, all as set forth in the letter. The company now considers putting on a large dredge of a "powerful California type." How long these English companies will continue to install the foreign types of dredges, which have proved so often to be totally inadequate for handling large yardage at a low cost, is an interesting question and should certainly be of vital interest to the directors of the company. In the first place, the property apparently had never been properly prospected, otherwise, the management would not have installed a dredge to dig 30 ft. deep when the operators have not found any bedrock at 67½ ft. depth, as stated. It would seem that the English companies could well afford to engage some of the well-known American placer prospecting engineers, and have their property thoroughly prospected, so that there would not be any such shameful waste of funds as the building of a dredge for a 30-ft. depth when apparently it should be capable of digging to at least twice that depth. Moreover, from my own experience, I would say that it is generally impossible to make any additional extension to the foreign dredges so as to remedy this defect, because it would necessitate the redesigning and rebuilding of the entire dredge.

American engineers have had far greater experience in placer prospecting and in successful dredging work than others, and it would seem that companies like the Dome Mining Corporation, Ltd., might well pocket their pride and engage an American engineering concern to direct their enterprise a little more successfully.

I have just returned from Colombia, South America, where I went to inspect the operations of another English company, which has followed in the same footsteps as the Dome Mining Corporation, Ltd.; that is, it equipped its property with an English-made dredge, which is thoroughly inadequate for the work in hand. The ground appears to contain good values, but the dredge has been struggling along for the last six months digging a little ground now and then, while the London company (the Nus River Gold Mines, Ltd.) has been footing the bills. This company, I understand, now is considering ordering an American dredge of a suitable type for the work in question; but, on the other hand, it now faces the difficulty of raising capital, because the English stockholders, who, having put up their money in good faith to carry out the recommendations of their engineers, now find that their operations are a failure. The dredge has been completed and operated for about six months and the company is still being called upon for further cash instead of receiving dividends. This dredge lacks all the necessary qualifications for successful operation, and the general engineering features of the entire project were faulty. This procedure not only damages the reputation of the industry, but it is also extremely wasteful of valuable dredging ground.

American engineering companies have set a very splendid example by the numerous successful gold-dredging enterprises that they have installed and operated in various parts of the world. There are many instances where the American type of dredge has been installed and operated alongside the foreign-built dredge, so we have many opportunities for a comparison, which seldom fails to demonstrate the superiority of the American dredge, engineering, and management.

Yonkers, N. Y. ROY GUIDERY.

Geology of Bolivia's Tin Veins

THE EDITOR:

Sir—It is a long way to New York from a tin mine. Comment that I had hoped to call forth in my article on certain geologic features of Bolivian tin veins that appeared in the April 17th issue of the *Engineering and Mining Journal* is just now beginning to come in.

O. M. Brown in the issue of July 10 mentions the occurrence of numerous small veins in the Quimsa Cruz district of Bolivia where very high grade cassiterite ore near the surface persists only a short distance on the strike and on the dip. To realize the full significance of this statement, it should be added that in the extremely rugged Quimsa Cruz district "on the strike" usually means going into the hill away from the surface as much as on the dip. Mr. Brown correctly concludes that this surface parallelism apparently supports the idea of secondary enrichment of cassiterite, for as I had stated in my article, it could not well be primary, as the present surface can have no possible correspondence with that existing at the time of the primary vein filling, let us say, Pliocene. It is indeed, in the longitudinal sections of these smaller veins that the secondary character of the orebodies is brought out with almost the simplicity and clearness of a diagram. In the larger and more important veins, due to the influence of crushed zones which produce areas of unequal porosity and thus modify the infiltration zone, the correspondence of the secondary orebodies with the surface configuration is not so evident.

Mr. Lester Strauss in the issue of Sept. 4—Mr. Strauss kindly sent me a copy of his contribution to the discussion—considers it unfortunate that I did not go into greater detail with regard to the country rock in the various veins cited, as well as not to have made mention of some important producers that lie wholly in the sedimentaries. Mr. Strauss apparently has misconstrued the purpose of my article, which was not to describe individual tin mines but to adduce evidence with regard to certain geologic features, principally secondary enrichment of cassiterite and the influence of the

depth of fracture on the character of the primary mineralization of the vein. I confined myself to such data as I thought strictly relevant to the matter in hand and avoided unnecessary details.

I do not think that the fact that a tin vein occurs in the sedimentaries, is in itself of such vital significance, since the original source of mineralization must in any event be the igneous rock. It probably would not greatly affect the character of the primary minerals coming from below and the point is of interest in a physical rather than in a chemical sense. For instance, if a set of high-temperature minerals were found in a vein cutting a thick series of sediments it implies a far-reaching fracture tapping a necessarily distant high temperature zone, and as a probable corollary a strong persistent vein might be inferred. The rich tin-silver vein of the Animas mine mentioned by Mr. Strauss is on a later fracture than the pyrite-cassiterite vein of the Oploca company which is cut by the former at an acute angle. The high-temperature pyrite-cassiterite group is found in the earlier vein, while the more moderate temperature cassiterite-stannite-tetrahedrite group is found in the later vein, which is quite in accord with our present conceptions of zonal arrangement of primary mineralization.

Mr. Strauss regards it as essential that chemical research verifies the possibility of cassiterite being dissolved and redeposited as SnO_2 at lower levels. It would indeed put the stamp of respectability upon this parvenu among processes, but with such a wealth of geologic facts as a foundation, it can afford to bide its time until its chemical credentials can be duly examined and it is even possible that in the meantime the tin miner might perhaps be able to make use of some of this geologic information.

In this connection, regarding the solubility of cassiterite, I have received a personal communication from E. H. Davison of the Geological Department of the School of Mines, Camborne, England, in which he speaks of "certain evidence which points to the possibility of cassiterite going into solution. For instance, bones have been dug up, in Cornwall, at the bottom of alluvial gravels in which the bony tissue was partially replaced by cassiterite." F. W. Clarke in "Data of Geochemistry," U. S. G. S. Bull. 616, p. 684, refers to a number of published statements of where such solubility had been observed.

On the other hand, in the issue of June 5, J. W. Gruner and S. C. Lin give us the benefit of some experiments made a few years ago on the solubility of cassiterite and stannite, using as reagents dilute hydrochloric and sulphuric acids, ferric and ferrous sulphates and sodium carbonate solutions in various combinations. The results were negative with regard to cassiterite. This is an important step in the chemical elucidation of the problem. It proves that dilute solutions of sulphuric acid and ferric and ferrous sulphates, such as might be expected to occur in a vein undergoing oxidation, are not in themselves sufficient to dissolve cassiterite. But this is merely a step in the right direction and does not dispose of the problem as the authors assume when they say, "The facts as stated for some Bolivian tin deposits cannot be explained on the basis of chemical behavior of cassiterite in the oxidizing zone." But, the possibilities of Nature's workshop are by no means exhausted. In the first place, pyrite is potentially a powerful reducing agent. The authors say, "Only a very powerful reducing agent like nascent hydrogen will cause tin oxide to dissolve in an acid solution. Under oxidizing conditions like those existing near the earth's surface in the zone of oxidation such powerful reducing agents are unknown." Now, cassiterite in close association with pyrite undergoing oxidation near the earth's surface is *not* under "oxidizing conditions" any more than is iron oxide ore in contact with coke in the hot air blast of an iron furnace. Anyone that has passed an old mine dump containing sulphides has noted the gases being given off—sulphur dioxide and even hydrogen sulphide, both of them reducing agents, and, like nascent hydrogen, especially active at the moment of formation, just when these gases would be in close contact with the cassiterite interlocked with pyrite. They also say, "But if one did assume that tin went into solution by reduction of cassiterite near the surface, then it would be impossible to explain its reprecipitation as cassiterite at a deeper level under reducing conditions." Why "reducing conditions?" The deeper level is merely a zone of relative chemical inactivity, but infiltrating waters will always carry some dissolved oxygen.

Furthermore, there is the possible catalytic action of other mineral associates and the electro-chemical action suggested by J. E. Spurr in an editorial on this subject (April 17 issue). There is indeed a vast field for research and much experimental work will have to be done before it can be averred that cassiterite is insoluble under the natural conditions usually obtaining.

The assumption that primary stannite may be the source of the secondary cassiterite is naturally an attractive "easiest way" of reconciling our present chemical knowledge with some of the observed geological facts, although as I stated in my article, I have never found stannite in anywhere nearly adequate quantities to account for the typically secondary deposits. Gruner and Lin, however, make the very fair suggestion that "though stannite seems to be present in inadequate amounts in the primary ore, which is open to inspection, to account for the enrichment of tin is it not possible that stannite was much more plentiful in the portions of the deposits now oxidized and eroded?" Let us assume that it was, and see what happens. The problem then is to transport the tin existing in the assumed form of stannite sparsely distributed in a big block of vein to its present situation of a compact orebody, actually observed, consisting of good grade cassiterite, not stannite. (Incidentally wood-tin is seldom found). Now, as the assumed primary stannite is being dissolved parallel to erosion, do the solutions carry their load from the different parts of the slowly eroding block in one journey to the present enriched body, like to a rendezvous, and there precipitate the tin as cassiterite in one single operation? Or, as is more likely, does the tin go through many cycles of solution, short migration, and reprecipitation, in a progression like a string of boys playing leapfrog? Reprecipitated? As what? If as stannite or other complex sulphide, why do we not find these minerals in quantity in the enriched orebodies? If, as cassiterite, we are already in the very second cycle of our operations brought face to face with the necessity of dissolving it in order not to stop the procession. There seems to be no other explanation. The chemists must find some way in which this mineral may dissolve and rescue these important secondarily enriched deposits from the humiliating role of the Irishman they couldn't put in jail.

F. R. KOEBERLIN.

Sanitago, Chile.

News of the Week

The Mining News given in ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

HYDRAULIC mining in California may be revived by impounding debris; Commission makes preliminary survey for establishing dam sites.

London platinum shares market uncertain — Lena Goldfield produces in excess of £1,000,000 in eleven months—German potash production standardized.

Copper imports from Chile declined in 1925—Tin production and price at new high with continued demand.

Review of mining progress in Japan—North African phosphate production increasing at a rapid rate.

Utah dividends larger than in 1925—Noranda lays out townsite.

Zonolite company erecting new plant at Libby, Montana—Treadwell-Yukon plans new mill—Western Apex conducts extensive development work.

France attempts to co-ordinate mining laws of 1810 and 1919, and eliminate perpetual concessions.

Mexican metal production increases; new laws complicated; mine accidents must be reported; El Oro drops 1,000 men.

Central Manitoba Mines being financed—Nickel industry on stable basis—LaRose sale ratified.

Coeur d'Alene district at its best—Abandoned Hector prospect may become mine.

United Metals Consolidates Coeur d'Alene Zinc-Lead Properties

The United Metals Co., Wallace, Idaho, is the latest addition to the list of strong mining organizations operating in the Coeur d'Alene district. As a result of quiet but continuous effort covering a period of about two years, the company has secured a fifty-year lease on 41 claims covering both sides of Bell gulch, near Gem, and extending east to the Star, owned by the Sullivan Mining Co. This consolidation includes the Bell, Mexican, Western Pacific and Goodenough groups of claims, and others. The area covers the western extension of the Morning-Star and the You Like veins. The United Metals Co. is now engaged in carrying out plans for development. In addition to these holdings, the company has also acquired control of 75 per cent of the capital stock of the Black Bear Mines Co., which secures a desirable operating outlet on Canyon Creek. The Black Bear not only provides the key to the development operations planned, but it also has a large tonnage of lead-silver and zinc ore already developed and now being explored by United Metals, which promises to result in proving tonnage for a mill regardless of the outcome of the main development directed at the Morning-Star vein. From the Black Bear workings the United Metals is now extending a crosscut almost due south, which it is estimated will cut the Morning-Star vein within 2,200 ft. and the You Like within 3,000 ft. The United Metals is financially sponsored by San Francisco mining men, chief of whom is W. C. Hammon, of the Yuba Manufacturing Co., who is one of the directors; M. W. Neary, of San Francisco, president; J. J. Hamlyn, of San Francisco, director and superintendent of operations, now residing in Wallace; Peter Bernier, of Wallace, vice-president, and Allen G. Kennedy, of Wallace, secretary-treasurer.

Increase in French Bauxite Production

The French output of bauxite during the first six months of 1926 is reported to be slightly higher than that for the corresponding period of 1925, and it is said that it would have been still higher but for the shortage of labor, according to a report made public by the Department of Commerce. Official figures for the 1925 production have not yet been received, but estimates place it at about 390,000 metric tons.

International Developing Through Yankee Shaft

Ten thousand feet of work has been done by the International Smelting Co. in developing its Eureka, Utah, holdings from the shaft of the Yankee Consolidated Mining Co. In addition to this work started from the Yankee shaft two years ago, the company is driving a heading from the Tintic Standard No. 2 shaft into the North Lilly group, where diamond drill holes have revealed significant geological conditions. Much development work from the Yankee shaft has been done on the 1,500-, 1,700-, 1,800- and 2,000-ft. levels.

Belmont Copper Gives Promise of Becoming Substantial Shipper

The Belmont Copper Company, Superior, Ariz., recently made its first shipment to the Magma smelter. The shipment consisted of 44 tons, taken from a crosscut on the 1,155-ft. level, yielding net smelter returns of about $34 per ton.

According to a late report of Mr. Ira B. Joralemon, consulting engineer for the company, recent developments have opened up five veins to the 1000-ft. level, and four of these have been cut on the 1,150 level. In the Eureka vein, two orebodies, with a total length of 220 feet, and a stoping width of approximately 3.5 feet, have been opened.

It is proposed to sink the shaft to the 1,600-ft. level and also to carry out development on various levels to open up the mine, and pay the balance due to the Consolidated Holding & Trust Co. on the option price of the property. The Board of Directors, is offering to the stockholders of record on Sept. 6, 1926, additional stock at par to the amount of $260,000, in the proportion of two shares of additional stock for every five shares held respectively by stockholders on the above date. The company took over the development of the property in April, 1925. A. Mackay, formerly connected with the Dundee-Arizona property at Jerome, is president of the Belmont Copper Mining Co., and Chester Hoatson is vice-president and superintendent. Arthur J. Smith is secretary and treasurer, and these three, together with Lewis W. Douglas, William Ferguson, R. F. B. Mackay, and P. G. Spilsbury, make up the directorate of the company.

Washington News

By PAUL WOOTON
Special Correspondent

Demand for Tin Strong Despite High Price—Copper Imports From Chile Fell Off

The American tinplate industry is using tin this year at an unprecedented rate, regardless of the high price. The industry is manifesting no great concern because of the price of its most important raw material. The increase can be passed on readily to the ultimate consumer who is not particularly disturbed by the fact that tin cans cost more.

The automobile industry is a large user of tin, but even at prevailing high prices the amount of tin going into a single automobile represents such an infinitesimal portion of the cost of the car that it escapes all notice from the purchaser. The babbitt metal makers, however, are in no such enviable position. They are protesting vigorously but they are not in a position to arouse public support.

Since the production of tin has about reached its peak, the only avenue of relief apparently is elimination of uses. That field possesses definite possibilities. While there is no reason to believe that tin can be substituted satisfactorily in bearings, there is more hope of finding something else to put inside of cans and with which to weight fabrics.

There is some uncertainty as to the potentialities of the tin deposits in Africa and as to the possibilities of the under-sea prospecting which the Dutch are undertaking, but all the indications are that the world's output soon will begin to fall off. The Dutch continue to assume the attitude of the unwilling profiteer, but as their 1926 production promises to exceed 20,000 tons, on which their profit is in excess of $900, it is thought that they are rather willing to continue to ride along under the British umbrella.

Agitation for a tariff on copper is said to be one of the reasons influencing American producers of that metal in Chile to ship to Europe direct instead of via the United States. The extent to which resort is being made to direct shipments is indicated by the decrease of imports of Chilean copper into the United States from 115,000 tons in 1924 to 74,000 tons in 1925.

The extent to which currency reform in India would affect silver prices is a matter of some controversy among silver specialists in Washington. Some expect the United States to be the important contributor of the gold which will flow into India, as the horded silver is dumped. The deflating effect of the gold export will tend to offset the decrease in the silver price which inevitably would follow.

Others are of the opinion that the increase in the purchasing power of the silver producer's dollar would be negligible and declare that our interest in India is too little to justify any sacrifice of our gold in furtherance of the plans of the Royal Indian Currency Commission. It is contended that we are much more interested in supporting stabilization in the European countries. Moreover, it is argued that the Indian situation is not such as to justify the exertion of great pressure on the world's gold reserve.

None will be surprised if the countervailing duty on Indian pig iron never is applied. The Treasury Department's order provided for the study to determine the proportion of the government's subsidy on steel which properly could be allocated to pig iron. There is no evidence that this study has begun. The declaration of intention of carrying the tariff act that far has aroused such a storm of protest that some believe the administration is willing to allow the matter to drop.

Information reaching Washington is that all independent producers of manganese in Brazil have suspended operations and that indications are that the Steel Corporation is cleaning up its properties preparatory to their closing.

The grade of the ore shipped from the developed deposits in Brazil, which formerly averaged more than 40 per cent manganese now is running barely 7 per cent, it is stated. This does not mean, it is explained, that the high grade ore in Brazil has been exhausted. There is every reason to believe that extensive high grade deposits exist but they are undeveloped. The million tons of ore shipped from Brazil during 1917 and 1918 seems to have taken so much of the good ore that the existing properties no longer are in a position to complete with those of the Caucasus and of India.

Ontario Gold Production Sets New Record

During the eight months ended August 31, the gold mines of Northern Ontario had an output of approximately $20,750,000, according to preliminary estimates. This output marks the highest record so far in the history of gold mining in the province. Not only were facilities increased to such an extent as to secure still further growth in the output of the immediate future, but the ore reserves at the mines were increased to a very important extent.

Noranda Lays Out Townsite

The Noranda Mines, in the Rouyn area of Quebec, is making good progress in laying out the townsite. Streets have been laid and graded and ditches dug, and a number of workmen's houses are being erected. The company is also building two new bunkhouses, which will be complete in every detail, and will accommodate about 70 men each. The number of workmen employed is now about 400. Work on the Horne smelter is being rushed, and excavations for the foundation are well under way. Grading for the railway which will serve the property is making good progress. The completion of the railway is expected in November, when delivery of machinery for the Horne smelter will be hastened.

Duprat Mines, Limited, operating in the Rouyn area of Quebec, has engaged J. Houston to direct the development of the property. At three points on property adjoining Duprat Mines there have been copper discoveries, and zones of mineralization have been discovered on Duprat itself. Mr. Houston will make a general survey of all these conditions, and will direct further surface trenching, preparatory to carrying out a systematic campaign of diamond drilling.

New Jersey Zinc Not Interested in Arizona

On Sept. 18, the *Journal* published as a news item from Chloride, Ariz., that the New Jersey Zinc Co. had secured options on zinc properties in the Chloride district. The company states that this is a mistake, that it has no interests whatever in this district.

Lead Cargo Melted in Train Wreck

A double freight train, reported to be carrying several cars of lead from the Trail smelter and coal from the Coalmont colliery to Vancouver, got beyond control on Coquahalla grade and trestle of the Kettle Valley Railway, recently. The train and trestle caught fire. Several of the train crew were killed and cremated. The lead was melted and flowed among the loose rocks.

Utah Dividends Ten Per Cent Greater Than In 1925

Dividends paid by Utah metal mines during the third quarter of 1926 aggregated $3,582,885, and $10,925,623 for the first nine months of the current year, which is at the rate of $14,000,000 annually as compared with dividends for 1925 which totaled $12,690,180. During the third quarter, the Bingham Mines paid $50,000; Chief Consolidated, $101,000; Mammoth, $40,000; Park-Utah Consolidated, $314,025; Plutus, $150,000; Silver King Coalition, $304,025; Tintic Standard, $461,166; Utah Apex, $132,050; and Utah Copper, $2,030,612.

Improvement in mine conditions at the Eagle and Blue Bell and Victoria properties of the Bingham Mines Co. at Eureka, Utah, as the result of recent strikes is reflected in the company's earnings for August. An estimate of the operating profit for August shows that the total jumped to $23,000 as compared with $14,500 for July and $9,957 for June. Net earnings for the first eight months of the Bingham Mines Co., using the foregoing figures, will equal approximately $156,762 or $3.13 a share or at the rate of $4.16 a share for the year. Dividend requirements are $4 a share on 50,000 shares.

The recent strike in a raise 70 ft. above the 1,400 level following close upon the strike in the Eagle and Blue Bell, has immeasurably improved the outlook at the Eureka properties of the company.

Progress of Mining in Japan

By Dr. J. Yokobori
Secretary Japanese Mine Operators Association

IN OUR country the mining industry is fairly prosperous, although the extraordinary conditions which prevailed during the Great War are not to be expected; and almost all kinds of metals and non-metals which are included under the mining law of the empire are now produced at a profit. During the last few years, gold mines, mostly in liparite or liparite tuff, sometimes in contact with shales, have been steadily developed in Kitami Province, the northern part of Hokkaido; and a great many of the mine leases are now in the prospecting stage, exciting the people and causing much interest in the mining industries. We have recently received good news regarding the discovery of several gold placer deposits in the northern and eastern districts of Formosa.

Among the oil wells in Formosa, which have been in process of drilling for a long time, No. 36 well had good success with an oil flow of 250 bbl. average a day from a depth of 760 meters; it is expected that new wells now drilling should bring good returns. Although we have some trouble about the supply of iron ore, yet a notable amount of pig iron and steel can now be produced in our country, in both government and private iron works, amounting to more than 1,000,000 tons a year; while a new plant with modern equipment is now coming into operation at the Anshen Iron Works, belonging to the South Manchurian Railway Co.; and a trial plant for the treatment of the enormous amount of iron sand in the northern part of the Island of Japan proper is to be erected.

Copper Mines Most Important

With regard to copper mining, which constitutes the most important situation next to the coal mining, we have at present the following big mines: Ashio Mine, Bessi Mine, Kosaka Mine, Hidachi Mine, Ikuno Mine, Osarusawa Mine, Tsuchihata Mine, and many others.

In most of these copper mines, the ore reserves are well determined for some time to come, and improvements are put into effect without hesitation, applying the most advanced methods and installations whenever it is found advisable. In the Ashio Mine, where very rich sulphide ores were recently found, they are recovering arsenious acid, metallic selenium, and metallic bismuth, the latter being extracted from the flue dust collected by the Cottrell electro-precipitation method, and then subjected to electrolytic separation by the Betts process. In the Bessi Mine, No. 4 level, 15,167 ft. long, was finished in five years, having been begun in 1910. The transportation of ore from the mines and the subsequent plan of treatment in the ore-dressing plants, are both expected to show great changes. A large mill is now planned to use the oil flotation process. The copper smelter for the Bessi ores is situated on a small island about 12 miles from the ore loading dock. It has been remodeled with rectangular blast furnaces and barrel converters and all kinds of auxiliary appliances driven mechanically, to save labor costs so far as possible. The electric power used at the smelter is transmitted by a submarine cable 68,432 ft. long, which may be the longest submarine power cable in the world.

In the Kosaka Mine, pyritic smelting was first used in Japan, for the treatment of low-grade sulphide ores consisting of basic mixed ore, called "Kuroko," having an intimate mixture of chalcoprite, pyrite, blende, galena, and up to 35 per cent barytes; and also for the so-called Ohko and Keiko ores, representing the pyritic and quartzose ores respectively. These ores may be utilized as self-fluxing materials, and an experimental blast furnace, with a hearth length of 60 ft., has been provided.

Flotation Experiments

In the Hidachi Mine, which has made a splendid advance within twenty years, since its ownership by the Kuhara Mining Co., every kind of possible experiment was tried and great efforts were made, which brought the newly developed mine into its present prosperous condition. Indeed, the mining engineers were careful to take advantage of those machines and apparatus for exploration and excavation which have been well proved in foreign mining countries, especially in the United States; they are also much interested in investigations regarding the selective flotation process, so as to get the copper concentrate as high as 20 per cent or more in copper, while the pyrite separated from the copper sulphide may be used for the manufacture of sulphuric acid.

In the electrolytic refinery of the Hidachi Mine, a new plant for getting the pure gold and silver was established, recovering also small traces of platinum and palladium from the bullion of the noble metals.

In the Ikuno and the Osarusawa mines, belonging to Mitsubishi & Co., many improvements have been made; in the former mine some promising deposits, carrying both wolframite and cassiterite, were found about ten years ago. The crude tin recovered at the mine's smelter is refined at the big central refinery in Osaka, also under the ownership of the same company, by the fluosilicate electrolytic process. This central refinery is the only one which is situated in the center of the industrial city, and has contributed much to the progress of the metal industries, producing also a large amount of electro-refined lead by the Betts process.

The Tsuchihata mine, which has been recently developed by the Tanaka Mining Co., is remarkable for its ore deposits, one of which measures 650 ft. by 800 ft. horizontally and is 300 ft. deep. The orebody has a great number of veins or veinlets, sometimes intersecting. A typical oil-flotation plant under the Minerals Separation system has just been built with a daily capacity of over 500 tons of the ore.

Besides these copper mines, we have many other productive mines. Further, we are glad to report that some zinc is now produced in our country, both by distillation and electrolysis; either a byproduct from the lead smelter, as is the case with Mitsui Mining Co.'s industries, or as a separate business as performed by Suzuki & Co. and Takata & Co.

With regard to coal mining in Japan and its auxiliary industries, I should like to take another opportunity to write of this, and I hope your readers will look at the pamphlets "Mining in Japan," fairly well describing the mining industries in our country to date. They can get them without charge by applying to the Japanese section in the Sesquicentennial International Exposition in Philadelphia.

Coeur d'Alene District Enjoys Real Prosperity

Ravenel Macbeth, secretary of the Idaho Mining Association, in a recent statement says that "never during my years of observation have I seen the future outlook of the Coeur d'Alene district so flattering. My opinion is based not only on the extensive program of development and construction work under way but also on the commanding position of lead in the world's markets."

"The Coeur d'Alenes in 1926," he said, "has experienced the greatest year of construction work ever known in the history of the camp. To enumerate: the electrolytic zinc smelter by the Bunker Hill; the 250-ton mill by the Federal on the Corrigan-Page group; the 150-ton mill by the Callahan on the Galena; the 50-ton mill of the Terrible Edith; the 150-ton mill of the Jack Waite, built earlier in the year and now operating; the doubling of their output by the Constitution and Highland-Surprise, through additional mill equipment; improvements at the Sweeney mill by the Bunker Hill to take care of increased production by the Star, Sidney, leasers and custom ores; improvements by the Snowstorm; the Hecla tailings mill; the Sidney tramway, now nearing completion, etc. . . . In not many months, eighteen mills, the largest number ever operating in the camp, will be treating about six thousand tons, daily. In 1923, leaving out the big companies, there were four producers; in 1925, seventeen, and today twenty-four, and the Hilarity, Hector and Delaware should increase this number to twenty-seven before the end of the year."

Abandoned Prospect May Become Shipping Mine

One of those frequent cases of hard luck in mining development was recently brought to public attention in the Coeur d'Alene district, Idaho, and as a result a long-abandoned prospect may soon become a producing mine. For many years, up to 1917, the Hector Mining Co. was engaged in developing a claim about three miles from Wallace, Idaho. The property was ideally located, the portal of the main tunnel

being within two hundred yards of the railroad and highway, and the ground being developed within a proved mineral area. Operations were financed by assessments which were levied with depressing regularity, and be it said to the credit of the management, the money thus raised was honestly spent in actual development work. Evidence of this is found in a crosscut tunnel over a mile in length. Failing to find ore or even a showing that justified further expenditure, work was discontinued. In the meantime claims were filed against the company and through foreclosure proceedings the property passed into the hands of new owners. As is often the case, a miner employed by the Hector company was a closer observer than the management. At a point 3,600 ft. from the portal a small stringer of galena was cut, which the management decided to follow. A fault intersected the vein at that place, and for a wide area the ground was badly broken, wet and hard to hold. Thus after drifting about ten feet with much difficulty, work was discontinued. Frank Pearce, a miner employed by the Hector, was convinced that the drift should have been extended in spite of bad ground. After the property passed into new hands he secured a lease and bond, and with the support of N. C. Sheridan and associates, the vein was entered about ten feet in advance of the drift started by the Hector management. The discovery has attracted much attention in the district, and again demonstrates the wisdom of the old miner who never quits a prospect until he has blasted one more round.

Calumet & Hecla to Start Long Crosscut

Calumet & Hecla, Calumet, Michigan, is setting up a temporary plant in the shaft house at No. 2, Allouez, preparatory to starting the crosscut from the 500-ft. level which will explore an area of widespread mineralization. All of the equipment used in the recent Cliff exploration has been moved to the shaft. The crosscut, which will get under way within a few weeks, will be driven between 2,000 and 3,000 ft., at least as far as the Houghton conglomerate and possibly beyond. A number of important veins will be cut. It is considered a most interesting area with its promising lodes, which will be cut at a sufficient depth to test them thoroughly as to their copper content.

Treadwell-Yukon to Enlarge Mill

Announcement has been made by the Treadwell-Yukon Co., Mayo, Yukon Territory, Canada, that it will enlarge its mill in the Mayo district, to double its present capacity of 100 tons per day. This is the first mill in this district to handle silver-lead ores. Previously, high grade ores carrying values of $100 or more per ton were shipped out and the early increase in milling capacity attests the success attained by the local operations. The present mill has been in operation less than two years.

California Hydraulic Mining Investigation

Construction of Enormous Dams for Impounding Debris Proposed—Preliminary Surveys Under Way

Under the direction of the State Hydraulic Mining Commission consisting of Lloyd Root, State Mineralogist and W. S. Kingsbury, Surveyor General, the State of California is conducting an investigation of the possibilities of rehabilitating the hydraulic mining industry which has been dormant for many years. Arthur Jarman, mining engineer, is now engaged in collecting data and making estimates in the field. Jarman in a recent interview stated that the first essential toward the resumption of hydraulic mining is the construction of impounding dams of such size that the cost to the mines for debris storage could be reduced to a low figure. Dams capable of holding from 100 to 300 million cubic yards will be necessary to meet this primary condition. The California Debris Commission Act is a Federal Act passed in 1893 to regulate hydraulic mining in the State of California. For the use of any debris dam constructed by the commission an impounding charge of 3 per cent of the gross output of the mine or mines is specified and if this section of the act be brought into active operation, hydraulic mining would be practicable where other conditions are reasonably favorable.

Commission 33 Years Old

The Debris Commission Act has been in operation for a period of 33 years and the commissioners have won the confidence of both the miner and the farmer by their fairness. Because of the fact also that the farmers have been adequately protected they undoubtedly would be suspicious of any attempt to alter or amend the act. It would therefore appear that whatever is done toward rehabilitation must be in conformance with the Debris Act. Under the terms of this act the commissioners are directed to initiate plans for the construction of impounding dams, and are directed and empowered to build such dams, "when appropriations are made therefor by law." (Sec. 25.) Construction of any dam by private parties is also under their supervision. Detailed surveys are now under way and it is expected that by the end of October the commission will have estimated the costs of construction and the storage capacities available for a number of proposed dam sites.

How to get actually started upon a construction program is the hub of the situation, said Jarman. Obviously it will be necessary to get appropriations and it is planned to obtain co-operation of State and Federal agencies upon a 50-50 basis. In order to make out a good case it is equally obvious that the initial work must be restricted to those watersheds that offer excellent opportunities for profitable hydraulic mining. The work of investigation is therefore narrowed down to the best probabilities and attention has been confined to rivers where considerable work was going on at the time and where restrictions created by the Debris Act were most onerous. The Bear, American, and the South and Middle Forks of the Yuba Rivers appear to be the most promising regions under this premise.

The Bear River drainage includes Dutch Flat, Lowell Hill, Quaker Hill, You Bet, Red Dog, and Little York mines. How much pay gravel is available on this watershed is hard to estimate. Grade conditions on this river are poor and as a consequence the scale of mining operations might be greatly reduced. Preliminary estimates indicate a minimum of 50 million cubic yards and a possible amount exceeding 100 million. Two good dam sites are held by interests favorable to hydraulic mining in this area, the owners hoping to erect dams for power generation, debris impounding and irrigation also. These sites, known as the Van Giesen and Parker sites have been thoroughly investigated with this purpose in view.

On the American River, three dam sites have been surveyed, two on the North Fork and one on the Middle Fork. The Middle Fork area contains Michigan Bluff and Forest Hill, but the North Fork includes Gold Run, Iowa Hill and Wisconsin Hill. It is estimated that the workable gravel deposits total 150 million cubic yards.

On the South Yuba, the North Bloomfield or Malakoff bank is available. At the cessation of gravel mining the North Bloomfield was working in low-grade gravel toward the east but was making a profit. Deposits of gravel to the west were of higher grade. It is known from detailed surveys that this portion of the channel contains nearly 200 million cubic yards and it is estimated that by means of a lower tunnel about 100 million cubic yards of good-grade gravel would be immediately available in this section. Further upstream at Relief Hill and at Omega, both of which properties paid when working, about 20 million cubic yards is estimated as workable in each mine.

On the Middle Yuba, the most important deposit is at Columbia Hill where the remaining gravel, occupying a channel 2½ miles in length, is from 150 to 300 ft. in thickness, the top gravel having been hydraulicked. Careful surveys here show over 700 million cubic yards available. The North Bloomfield and the greater part of the Columbia Hill deposits are controlled by the interests owning the Empire mines of Grass Valley.

Two dam sites are under investigation on the Middle Yuba and two on the South Yuba. In all, six dam sites are specifically included in the initial program. Present plans involve consideration of dams up to 250 ft. in height capable of impounding from 100 to 200 million cubic yards. The Debris Commission's engineers are surveying these dam sites and the cost of impounding the hydraulic mining debris will be computed for each. If the dams are feasible on economic considerations and are constructed, both small and large properties can be operated and the in-

terests of the farmer will be duly safeguarded.

Jarman, while admitting the shortness of the working season in some places, believes that there is sufficient water now available and at a low enough cost on the watersheds in question to admit of hydraulicking on a scale to be remunerative.

Zonolite Company Erecting New Plant

The Zonolite Company, Libby, Mont., is constructing a new four-story mill that will treat one hundred tons of zonolite in twenty-four hours. Besides a large revolving kiln, the plant will include pulverizing facilities and screens to size the treated and milled zonolite to the various meshes desired.

A number of wallboard, steampipe and boiler covering concerns are using zonolite and these companies are rapidly increasing their consumption. A manufacturing plant has been built in Spokane to fabricate a zonolite wallplaster as well as a zonolite kalsomine. A zonolite-asphalt roofing and stucco has been devised which is fire resisting and which is warranted for twenty years without painting or repairing.

In connection with the wall plaster, it is meeting with favor, not only with the contractors and those applying it, but with the owners of the buildings in which it is used. Compared with a weight of 60 lb. per square yard for lime-sand plaster, when applied, wet zonolite plaster weighs about 20 lb. to the yard. After curing, the zonolite plaster weighs a trifle more than 7 lb. to the yard as against over 40 lb. for the lime-sand plaster. The zonolite plaster is strong and fireproof and possesses, by test, the insulation property of an eight-inch common brick wall. Many more yards of surface can be covered with zonolite plaster in a given time than with lime-sand plaster on account of its smooth texture and non-abrasive property. It further lends itself most admirably to the prevailing mode of stippling into various rough surfaces.

Alaska Juneau in August

During August, 1926, Alaska Juneau mined and trammed to mill 327,000 tons from which was recovered $151,000 or 46.18c. per ton at a cost of $146,250 or 44.73c. per ton resulting in an operating profit of $4,750 or 1.45c. per ton. Other expenditures and accrued charges, totaling $31,750, caused a deficit of $27,000 for the month. Additions to milling plant are reported 85 per cent completed and Ebner preparatory work 92 per cent completed.

Toronto Letter

By Our Special Correspondent for Northern Ontario

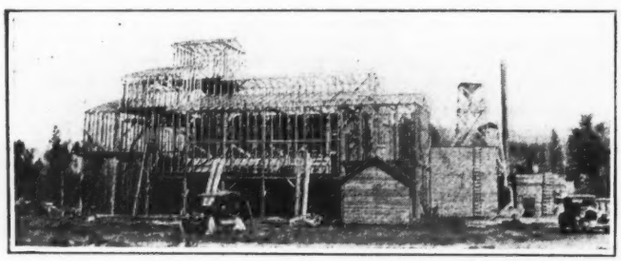
Central Manitoba Mines Being Financed—Nickel Industry On Stable Basis

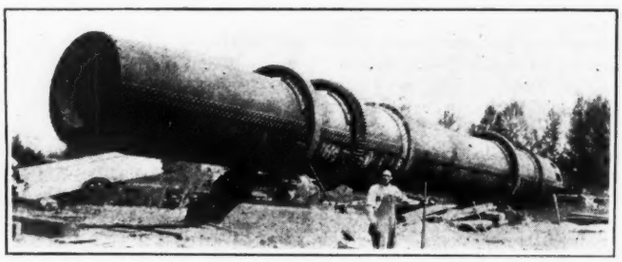
A short time ago a deal was made with a syndicate of brokers to underwrite 1,000,000 shares of the stock of the Central Manitoba Mines, Ltd. Representatives of the Syndicate, together with engineers who have been examining the property, have just returned and are understood to be pleased with developments. The Central Manitoba Mines, Ltd., has been financed, during the past couple of years, by John Taylor & Sons, of London, and their associates, who are represented in this country by the Anglo-Canadian Explorers, Toronto, Ont. To date over $600,000 has been spent on the property. The main shaft has been sunk 375 ft. with a winze to 475 and with drifts at 125, 250 and 375-ft. levels. The property embraces a large acreage and covers about 3 miles on the strike of the "break." The ore shoots occur along this "break," and what is known as the Kitchener vein has been proven for a length of 1,000 ft., while on the Hope ground, several thousand feet away, where only a comparatively small amount of work has been done, there is a surface exposure about 200 ft. long which averages about $20 over widths of 10 to 18 ft.

The new issue will provide for additional development and mine equipment and also for a 200-ton mill to be put in this winter. Tests on the ore are now being made in Cobalt and Ottawa and it is expected that orders for equipment will be placed in the near future. The issue of this stock will represent a comparatively new procedure in this country as the English practise will be followed and the shares will be issued at not less than par. As a matter of fact it is expected that a considerable premium will be asked and buyers of mining stocks will have to be educated to this security. It is however considered to be an extremely promising property and one of the most important gold discoveries of recent years. The company has an authorized capital of 4,500,000 shares of $1 par.

The Board of Directors has recently been strengthened by the addition of the Hon. Lionel Howland, chairman of the Mysore Gold Mines of India, and Henry Taylor of the firm of John Taylor & Sons.

Sir Alfred Mond, chairman of the Mond Nickel Co., has been visiting the company's holdings in Canada and the United States. Sir Alfred appears to be very pleased not only with the favorable progress being made by the company which he represents, but also by the developments which have taken place throughout Northern Ontario as a whole. He does not expect that the progress of the nickel industry in Ontario will be featured by any boom, but that there will be a steady and gradual expansion. Nickel is assuming its place among the stable markets of the world and is filling an important field as an alloy for use with other metals. An extensive field is opening up in the English trades where nickel is used as an alloy and Sir Alfred stated that several of the most eminent metallurgists in England are at present working upon plans for the increased use of nickel in the automotive industry. It is expected that the broadening of the market, which is constantly taking place, will lead to a gradual increase of the company's plant at Coniston in the Sudbury district. The Mond Company appears to be quite satisfied with the location of the refinery at Swansea in Wales and it has no intention of changing its location.





Zonolite mill nearing completion. Rotary heat-treatment kiln at right

Wright-Hargreaves Encounters Good Ore on Deep Level

High-grade ore is being encountered in the drifts of both veins on the 1,250-ft. levels at the Wright-Hargreaves, Kirkland, Ont. The mill ore of this property has been running about $14 a ton, while the new ore encountered is of such a grade as to raise this amount. With the mill treating over 400 tons a day, Wright-Hargreaves is for the time being, the largest producer in the Kirkland camp. The new flotation unit which is housed in a separate building, has started operations. A flotation unit will also be installed in the new mill of the Teck-Hughes.

LaRose Sale Ratified

At the adjourned meeting of the shareholders of the LaRose Mines, Ltd., Cobalt, the sale of the assets to a new company known as the LaRose-Rouyn Mines, Ltd., was ratified. The new company has a capital of 1,500,000 shares, 750,000 of which will be exchanged for shares in the old company on the basis of one share of LaRose-Rouyn for two shares of LaRose Mines. Shareholders subscribed to 200,000 shares of the new stock at 15c. a share and an underwriting syndicate has agreed to take up 500,000 shares at 20c. a share, which will assure the company sufficient money to carry on further development in Cobalt and to explore the properties in Quebec.

Paris Letter

By Francis Miltoun Mansfield
Special Correspondent

France Harmonizing Mining Laws of 1810 and 1919—Phosphate Production

Paris, Sept. 5—The chairman of the mining committee of the chamber of deputies has formulated decisive objections against the nationalization of French mines as a means of bringing cash to the national treasury in favor of a plan which will increase production on a royalty basis.

To accomplish this it will be necessary to harmonize the mining laws of 1810 and 1919, which latter law suppressed perpetual concessions, limiting those to be granted henceforth for 99 years, with certain exceptions for 50 years. The government is to profit in addition to hitherto preconceived royalty measures by a participation in superprofits—if, or when, there are any.

The chairman of the committee in question Monsieur Charlot, Deputy from the Cote d'Or believes further that it is not impossible to abrogate the perpetual concessions already endowed with the government signature. He finds the solution of the problem closely allied with the régimé in force with respect to the exploitation of hydraulic power. Certain previous perpetual water power concessions, under a law of 1919, have been readily assimilated under a seventy-five year régimé whereby at the end of that period the concessionaires will receive an indemnity for eviction to run up to the end of the 99 year period, it being a *sine qua non* that the perpetual lease under such an arrangement be considered an emphyteotic lease, or one subject to foreclosure, as the Napoleonic law provides. The indemnity proposed will equal one quarter of the value of the property expropriated.

The perpetual concession and the 99 year concession will accordingly become synonymous, with the right of expropriation after seventy-five years on the basis of payment suggested, or actual purchase by the government after fifty years on terms mutually to be agreed upon by the parties interested.

The plan if ultimately accepted presumes a revision of the working profit or royalty agreements hitherto entered into by the model formula which was accepted by the French mining industries in 1920. In default of arrival at a mutual understanding as to the *modus operandi* it is further proposed that all royalty, exploitation or concessions contracts be equalized for all mining operations wherein the State is interested.

Mining advances to the State on exploitation of French mines stood at 6.8 per cent in 1913 whereas in 1926 they run actually to 26 per cent. Further, taking into consideration the taxes paid to the government on the capital invested, and this to the exclusion of the general income tax on the part of stock and bond holders, the state gathers to its coffers quite one half of the entire revenue of the mining industry. The coal mining industry in France claims that the ensemble of taxes now paid exceeds six francs a ton brought to the surface—more than the net dividend paid to stockholders.

The mine operators conclusion is that hands must be kept off any proposition that already furnishes the State so satisfactory a revenue as is shown. The whole matter is to come on the tapis again with parliament in October.

North African Phosphate Production

The potential riches which France possesses in her North African provinces and protectorates are great, the most appreciable of these being the phosphates of Algeria, Tunisia and Morocco. Of the estimated world production of phosphate of 7,500,000 metric tons North Africa enters the lists with approximately four millions. The belief of French exploiters, shippers and distributors is that North Africa will ultimately supply all European demand.

Algeria was the first of these divisions to exploit the phosphate in its territory. In 1893 production was 5,118 metric tons, increasing in 1925 to 760,000 tons. The industry developed under some difficulties and set backs but the final status represent a tangible resource in the French inventory which is exceedingly appreciable in the economic balance sheet.

In Tunisia numerous physical advantages and a more liberal mining law régimé led to a far more rapid and considerable development. The production of 1900 of 173,000 tons has increased in 1925 to 2,691,000 tons.

Morocco appears to have been even more favored. The "Office Cherifien des Phosphates" has paternally guarded the interests of the government while at the same time encouraging an intensive exploitation. The deposits are exceedingly rich. From 33,000 tons in 1921 production reached 711,000 tons in 1925 and, it is believed, will reach 900,000 tons in 1926. Moroccan production has already reached that of Algeria and is planned to soon equal and even surpass that of Tunisia.

El Oro Drops 1,000 Men

The El Oro Mining and Railway Co. (State of Mexico) has given notice of the laying off of 1,000 men within 30 days and the final abandonment of the camp. Such of the machinery as can be utilized will be transferred to La Noria property in Zacatecas, and many of the miners and their families are already being transported there. A close down of other properties in the same vicinity, notably Dos Estrellas, because of inability to secure timber owing to the complex rulings of the forrestry commission, is also threatened. The El Oro Mining and Railway Co. has been a record producer for more than a third of a century.

Baldwin Finds Gold in Outcrop

A discovery which is regarded as the most important made for some time in the Kirkland Lake area of northern Ontario is reported on the Baldwin-Kirkland Lake property where operations were recently resumed. A vein having a width of at least 40 ft. has been found on the surface about 700 ft. south of the shaft and almost in the center of the property.

Mexico City Letter

By W. L. Vail
Special Correspondent

Metal Production Up—New Mining Law Criticised by Mine Operators

Mexico City, Sept. 4.—Metal production for the first six months of this year was considerably in excess of last year's production, according to figures given out from the Department of Commerce and Industry. Zinc led the procession. The total figures for the month of June were: 26,900,606 pesos as against 21,113,954 pesos, last year. In well-informed mining circles it is predicted that the new mining laws which went into effect Aug. 1, will have a deterrant effect on production during the later months of this year. The new laws have not found favor in the eyes of mining interests, big or little. Officials of the National Chamber of Mines deny they had a hand in their making or that they were consulted by the Department of Commerce and Industry. As a matter of fact the proposed laws were submitted to the Chamber three days before the expiration of the time allowed by Presidential Decree for their enforcement and with the statement that suggestions regarding changes in essentials would not be entertained. The Mining Chamber, therefore, refused to make observations.

It is the frank contention of leading mine operators and officials of mining organizations that the new law is unconstitutional, (1) because the law was promulgated after the time set by law for its enforcement; and (2) because Article 29 of the Mexican Constitution is specific with regard to extraordinary powers of the President. It is maintained that the chief executive in decreeing the new mining law exceeded his powers.

The new laws are extremely intricate and from the standpoint of the operator, susceptible to all sorts of official abuses. Concessions, for a limited period are substituted for the old system of titles. Concessions are subject to extension upon recommendation of inspectors and the good will of the President. The amount of red tape necessary, for example, in the construction of a metallurgical plant and the inability of the owner to dismantle the plant and remove the same, when it becomes useless, is one of the many obstacles pointed out by practical mining men. Cash deposits required, refusal to permit the concessionaire to dispose of ore during development, and a system of taxation hardly understandable, are some of the high lights of the new laws.

Government geologists report the location of what they believe to be a new highly mineralized copper zone near Santana, Sonora. The section enjoys excellent transportation facilities.

The Department having to do with mining affairs sent out a circular recently to all mine operators, reminding them of the obligations, under the law, to make prompt report to headquarters of all accidents, and of the penalties attached in the event of failure to send in proper returns.

London Letter

By W. A. Doman
Special Correspondent

Falcon Mines May Conclude Option on M'Tuga—Platinum Share Market Uncertain

London, Sept. 7—Although it has not been announced that the Falcon Mines has exercised its option on the M'Tuga property in Northern Rhodesia, the issued capital is to be increased. This is assumed to mean that the option will be concluded. Four hundred thousand 5s shares will be offered to shareholders, and a similar number will be under option at par to the Gold Fields Rhodesian Development Co. and the London Investment Syndicate for two years. The M'Tuga concession is within the Congo Border Concession area, and a decision must be made during the current month. The ore occurs as chalcopyrite in a porphyritic granite formation, the widths varying from 5 ft. to 30 ft. So far the company has not proved either the value or the extent of the orebodies.

After being depressed for some weeks, the condition of the platinum share market has improved. There is talk of a move being on foot to regulate the output, and it is hinted that an American syndicate is taking part in the negotiations. Some mining men are smiling as they confess they have not yet seen any signs of the production being excessive. But the share market must be considered, and the most unlikely story is good enough to put up prices.

There is considerable discussion on the prospects of the Southern Rhodesia Base Metals Co. The shares fluctuate in a most disconcerting way for nervous holders. Engineers who have been in the vicinity of the property express themselves in a most enthusiastic manner, but they say their optimism receives a check when they apply to the London office for information. Perhaps the directors are not to be blamed for acting cautiously, as the area is extensive, and naturally requires time to prove. Bear operators have been at work, though they have not met with much success.

For the first eleven months of operations the Lena Goldfields (Siberia) has produced gold of an aggregate value of £1,021,900. Some of this gold, as I have previously mentioned, has found its way to this country. No official statement has yet been made as to working costs, or the proportion of profit that accrues to the shareholders, and this omission is doubtless the reason for the difficulty experienced in lifting the price of the shares, though strenuous efforts have been made. Statements have been put forward that no difficulty is being experienced with the Soviet and that the latter is raising no objection to the company's profit being remitted here. According to the statements one-third of the amount of gold won is profit, but the Stock Exchange remains sceptical pending an official statement.

The tin market remains very strong. and the £300 per ton mark has at last been reached. That it will be even surpassed is clearly the view of metal dealers and this view is repeated by chairmen of tin mining companies. F. A. Robinson, of the Anglo-French Exploration Co., speaking at the statutory meeting of the Anglo-Burma Tin Co., last week, expressed himself in a most hopeful strain, and even hinted at a tin famine, as stocks are only equal to five weeks' requirements, and output cannot be immediately increased. There is reported a discovery of important tin deposits in the Transvaal.

German Potash Production Standardized

A report to the Department of Commerce states that the German potash industry is emerging from a period of development marked by standardization of production and concentration of mining operations at the best mines and refining in the best works. The competition of foreign countries, particularly France, resulted in the drive to eliminate wasteful methods in the industry, particularly the operation of many of the mines where costs of production were much higher than those of mines yielding salts richer in potash content.

Of 224 potential potash shafts in Germany, 118 are closed down definitely until 1953, under the 1919 potash law, while approximately 70 are now fit for operation, of which 42 are running and 28 are in reserve. At the present time 40 factories are engaged in the refining of crude salts.

Concentration, however, has been a costly venture. It forced the potash syndicate to enter the world's money market to raise $75,000,000, repayable in 25 years at 7 per cent interest. The indebtedness of the entire potash industry is estimated at approximately 450,000,000 to 500,000,000 marks.

In addition to being faced with these liabilities, the syndicate also must consider dividends to stockholders. Immediate relief does not appear to be forthcoming in increased business, for sales so far in 1926 have been tending downward. Sales amounting to 733,666 metric tons of pure potash in the first half of 1925 decreased to 601,000 tons in the parallel period of 1926.

Shortage of Labor at Michigan Copper Mines

The Lake Superior labor situation presents no important change other than the return of farmer-miners to underground positions and a slight improvement in tonnage from all the operating mines. For the present none of the lake mines is importing labor from other fields and increases due to immigration are negligible. Still the mines have fared well during the year with an approximate increaase in underground forces of 600 men since Jan. 1. Forces are far below requirements, however, for Calumet & Hecla could use fully 200 more men in the amygdaloid department and Ahmeek; Quincy has vacancies for at least 100; Copper Range could conveniently find places for 150 men and Mohawk and Seneca are slightly undermanned.

Johannesburg Letter

By John Watson
Special Correspondent

Transvaal Sets New Gold-Production Record

Johannesburg, Aug. 17—The monthly output of Transvaal gold for July was declared by the Chamber of Mines, on Aug. 10, as 860,134 oz., having a value of £3,653,617. These figures show an increase of 7,989 oz. and £33,935 value, over the June output, which held the record; so that, for the fourth month, this year, the monthly record has been beaten. Amongst the most notable increases, Government G. M. Areas had 3,947 oz. increase, over the June figures. New Modder had an increase of 1,234 and City Deep 1,144 oz. The native labor returns show 182,262 "boys" working on the Witwatersrand gold mines on July 13.

Onverwacht Platinum milled 1,560 tons of ore during July. The crude metal produced is estimated to contain 849 oz. of platinum and allied metals, equivalent to a recovery of 10.9 dwt. platinoids per ton of ore milled. The prospecting shaft, which is being sunk to the 350-ft. level, has been sampled to a depth of 333 ft. The values averaged 3.7 dwt. from 300 ft. to 310 ft.; 8 dwt. from 310 to 320 ft.; 8.6 dwt. from 320 to 330 ft. and 11.6 dwt. from 330 to 333 ft.

On the Johannesburg Stock Exchange, during the past week gold shares have remained firm. Rand Mines improved on Saturday (Aug. 14) to 60s. Brakpans have been in demand and their price has risen from 83s. 3d. to 84s. 6d. Sub-Nigels were again the chief feature of the market. They were largely dealt in, with fluctuations in price, closing the week on Saturday at 60s., i.e. 9d. lower than the previous week. Onverwacht platinum was in considerable demand, closing the week at 19s. 9d. Potgietersrust platinums have remained steady at about 9s. 3d.

French Pig Iron Production Reaches New Record

During August the French iron and steel market became a buyers' rather than a seller's market with the production of steel booming, according to the U. S. Department of Commerce. The July production of pig-iron reached a new record level with 792,000 metric tons. The month's output of steel ingots and castings was also high, with 718,000 tons, but did not set a record. If the present rate of production is maintained throughout 1926, pig-iron production should reach a cumulative total of 9,000,000 tons and that of steel ingots and castings 8,500,000 tons.

Exports of French iron and steel to the Continent are being made on a pound sterling basis, and because of the recent appreciation of the franc, are now approximately 10 per cent below prices quoted on domestic sales made f.o.b. plant. Domestic buyers are withholding orders expecting a decline in prices. Principal producers are now absorbing minor increases in costs and are offering one to two months deliveries instead of three to six months. They are seeking domestic rather than

foreign business because it is the more profitable. International prices of iron and steel will probably decline with the settlement of the British strike but this effect may be counterbalanced if the Continental steel entente is signed this month, which is likely provided that the Belgian producers agree upon the internal division of their quota.

Working Face Advanced 937 Ft. During August

A. G. Guthrie & Co., contractors, St. Paul, Minn., have a contract for driving the eight-mile Cascade tunnel for the Great Northern Railway in the State of Washington. During the month of August one working face 8x9 ft. was advanced 937 ft. Details are not given as to type of drills, number and length of shifts, number of men employed nor the character of rock encountered. The contractors believe this is a world's record. Can any one beat this performance?

Arizona Commission Authorizes Sale of Stock

The Arizona Central Mines Co., operating in Yavapai County, Arizona, has been issued a permit by the State Corporation Commission to sell 200,000 shares of its capital stock, at 50c. per share. A new road is being built to connect the property with the Jersey Lilly road.

Permission has been given to the Kaaba Mining and Milling Co., operating a mine and mill four miles west of Round Valley, southeast of Kingman, to sell to its stockholders 61,563 shares, at not more than $1.25 or less than $1.00 per share, the proceeds to be used in increasing the capacity of the mill to 100 tons a day. The ore is concentrated by oil flotation, and the gold-lead-silver-vanadium concentrate smelted in a reverbatory furnace which has been installed at the mine. The base bullion will be shipped to the Selby refinery.

Another New Mine in the Oatman District

The Western Apex, formerly the United Western, reorganized, which adjoins United Eastern holdings on the west, promises to add a new producer to the Oatman district. A year ago the shaft in the Western Apex had reached the 500 level where drifting disclosed a well-defined lode, carrying values of $2 to $7. As this was noncommercial, outside attention was not attracted to the property until recently when George Long, took an option on a large block of stock and financed the company sufficiently so that the shaft might be continued to the 700-ft. level, and a 200-ft. crosscut driven to the vein, where the lode was 3 ft. wide, averaging approximately $12. From this point, drifts were driven east towards the United Eastern line, and westward. The lode now has been opened up for a total distance of about 700 ft. A section of approximately 350 ft. towards the United Eastern, averages from 3 to 10 ft. in width, while the western 350-ft. section carries ore off and on.

Societies, Addresses, and Reports

Oxygen Discussed at Meeting of San Francisco Section of the A. I. M. E.

The first fall meeting of the San Francisco section of the Institute was held on Sept. 14, 1926, at the Engineers' Club. Oliver C. Ralston of the U. S. Bureau of Mines presented a paper on oxygen and its possibilities of extensive use in the metallurgical industries. To Dr. F. G. Cottrell was given the credit for first visualizing the possibilities of an oxygen industry and to Dorsey Lyon credit for putting in motion the machinery in this country which will, if anything does, result in the large scale production of oxygen. At present oxygen is produced commercially in relatively small amounts by electrolytic, air liquification, and fractional distillation methods as in the Linde and Claude processes. The first method is seriously limited and the air liquification methods are of low thermodynamic efficiency. In all about 150 tons of oxygen per annum is produced by some 50 oxygen liquification and a number of electrolytic plants. The lowest cost is about $12 per ton which figure does not afford promise of expanding use of oxygen.

However, under the stimulus of the Board of Oxygen Engineers, headed by M. H. Roberts, an experimental campaign has resulted in improved methods for the production of oxygen and the preliminary work has reached such a point that the production of oxygen on a commercial basis at a cost of $3 per ton is considered within reach. Present plans involve output to provide oxygen for a large scale experimental campaign.

Ralston discussed the possibilities of using oxygen in various metallurgical processes. He stated that the use of oxygen-enriched air in the iron blast furnace had been talked about most. The probable elimination of blast-heating stoves, an increase in blast furnace capacity and a saving of fuel are indicated. Oxygen will find application in the production of ferroalloys and in blast furnaces and other types of furnaces. In converting iron to steel in the Bessemer converter the use of oxygen will perhaps result in the production of a bessemer steel equal in grade to the open hearth product. He pointed out the probable advantages of the use of oxygen in open hearth steel furnaces.

Vancouver Board of Trade Tours the Kootenays

Speaking at Nelson, B. C., recently, at a banquet given to the members of the Vancouver Board of Trade, who toured the Kootenays with the object of cementing friendly trade relations between the coast and eastern British Columbia cities, J. J. Warren, president of the Consolidated Mining & Smelting Co. of Canada, stated that the value of his company's output for the present year would exceed $35,000,000, as compared with $30,000,000 for last year. The company is employing 4,000 men, and its monthly payroll exceeds half a million dollars. At present the monthly output is around 10,000 tons of lead, 5,500 to 6,000 tons of zinc, and 800 tons of copper, worth approximately $2,500,000 exclusive of the precious metals that are recovered from the base metal ores. Of last year's production of $30,000,000, only $9,000,000 worth of metal was marketed in Canada, the remainder was exported, chiefly to the Orient and to Europe. More than $10,000,000 worth of metals was exported through the port of Vancouver and $6,000,000 worth through eastern ports.

Continuing, Mr. Warren said that, though he had nothing definite to announce at this time, extensive expansion to the company's plant was under consideration. The tailing from the Sullivan mine ore, which is composed chiefly of sulphides of iron, is being accumulated for future use.

Movies Entertain Engineers

At the monthly meeting of the South African Institution of Engineers, held on Aug. 12, in Johannesburg, a film was exhibited, showing the various steps taken in the manufacture of a 50,000-kilowatt Parsons turbine machine, kindly lent by Messrs. C. A. Parsons, Ltd., of Newcastle-on-Tyne. Other films, "The Magic of Gold" and "Tube Milling," kindly lent by the Transvaal Chamber of Mines, were also shown.

Northwest Engineers to Hold Meeting at Spokane

An interesting series of papers has been arranged for the joint meeting, Northwestern branch of the American Institute of Mining and Metallurgical Engineers and the British Columbia branch of the Canadian Institute of Mining and Metallurgy, to be held at Spokane on Oct. 13 and 14 and to be continued at Cranbrook on Oct. 15 and 16.

Montana Section, A.I.M.E., Has Interesting Meeting

A meeting of the Montana Section of the American Institute of Mining and Metallurgical Engineers was held at the Montana Hotel, Anaconda, Mont., Wednesday evening, Sept. 15, 1926. A dinner was served preliminary to the technical program.

"Recent Progress in Metallurgical Processes" at Chile Copper Co., Chuquicamata, Chile, and the Andes Copper Co., Potrerillos, Chile, was the subject of a talk by Frederick Laist, metallurgical manager, Anaconda Copper company.

"Procedure Followed in Designing and Constructing Metallurgical Plants" by M. R. Hull, designing engineer, Chile Copper Co.

"Packed Cell Acid Plants" were discussed in connection with recent development in the fertilizing field, and the manufacture of phosphoric acid by E. L. Larison, superintendent acid and phosphate plants of the Anaconda Copper Company.

People You Should Know About

T. A. Rickard is now in London and expects to sail for New York, Oct. 30.

Albert S. Knoselman, mining engineer, Los Angeles, Calif., is in New York on professional work.

Chas. A. Mitke is in Ohio on professional business.

Stephen Vivian is in northern Spain, where he is developing a large copper enterprise.

W. F. Thomae is taking a holiday in Switzerland.

F. H. Hamilton is expected in London on his return from Ontario.

E. T. McCarthy is inspecting mines in Austria.

Cecil Baker, of the Consolidated Gold Fields of South Africa, has returned to New York from London.

Milnor Roberts, professor of mining at the University of Washington, Seatle, Wash., is examining mining properties near Baker, Ore.

Thomas C. Baker, manager of the Comstock Merger Mines, Inc., Virginia City, Nev., was recently in San Francisco on a short business trip.

Frank Corwin, assistant manager, United States Metals Refining Co., has returned from a professional visit to Cuba in the interest of the American Metal Co.

Philip R. Bradley of San Francisco has returned from Juneau, Alaska, and is in the Sudbury district where exploration work is in progress under his direction.

Harry W. Gould, mining engineer of San Francisco, is investigating quicksilver properties in Arizona.

W. H. Corbould, managing director of the Mount Isa Mines, Ltd., Queensland, Australia, recently left Mount Isa, where he had been superintending mining operations, for Great Britain, on business connected with his company.

Lionel Holland, of London, chairman of the board, Mysore Gold Mining Co. and **Henry C. Taylor,** of London, head of the firm of John Taylor & Sons, were added to the directorate of the Manitoba Central Mines, Ltd. **Henry A. Wentworth** is president, and **Howard Clark Davis** is treasurer of the company.

Mark Albertson, a member of the Tariff Commission's engineering staff, has returned from abroad where he has been investigating production costs of magnesite and of fluorspar.

J. O. Elton, manager of the International Smelting Co., returned to Salt Lake City from a three weeks' vacation trip in the northwest and left immediately for the property of the Walker Mining Co., Plumas County, California.

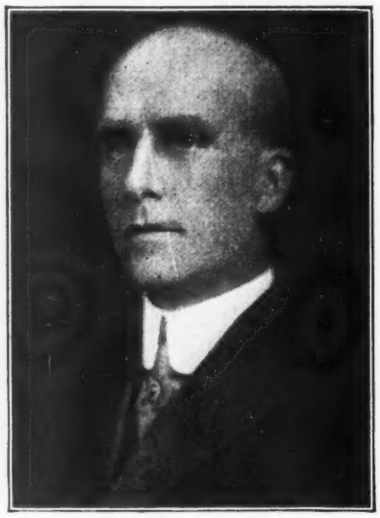
K. F. Hess, of Hess and Mette, Los Angeles, Calif., who has recently returned from the examination of mining properties in Colombia, South America, is now in the Abitibi district of Northwestern Quebec, where he is examining mines for the Alpha Gold Mines, Inc.

E. J. Carlyle sailed from New York, Sept. 17, for Peru.

Geo. H. Garrey is in Nevada where he has been making geological examinations of the Piermont, the Ruby Hill Apex mine, and other mines in the vicinity of Ely, Nevada.

Carl Davis, consulting engineer to the Anglo-American Corporation of South Africa, sailed from Capetown, Aug. 20, by the "Carnarvon Castle" on a three-months' visit to London.

Dr. Richard B. Moore, general manager of the Dorr Company, has resigned his position, and on Oct. 1 will take up the duties of Dean of the School of Science and Head of the Department of Chemistry at Purdue University.



Dr. Richard B. Moore

George W. Lambourne, president of the Park-Utah Consolidated Mines Co., and **J. A. McIlwee,** of Salt Lake City, have sailed from England and will arrive in Salt Lake City about Oct. 1.

Carl J. Trauerman, mining engineer of Butte and editor of the "Montana Natural Resource Bulletin" has been appointed a member of the National Committee on Publicity of the Massachusetts Institute of Technology, of which Duncan R. Linsley, of Harris, Forbes & Co., New York City is chairman.

Rush J. White, Wallace, Idaho, mining engineer for the Hecla Mining Co., left on Sept. 12 for Haines, Alaska, and the Stampede group of gold claims in the northwest corner of British Columbia, which he will examine for the Hecla company.

C. Price-Green, Commissioner of Natural Resources for the Canadian National Railways, is investigating the lead and zinc resources contiguous to the Canadian National Railway in British Columbia, to ascertain if sufficient ore could be developed to support a smelter.

W. J. Walker, D. Sc. (Dundee) has been appointed De Beers professor of engineering in the Witwatersrand University, in succession to **Prof. John Orr,** who recently became principal of Johannesburg Technical College.

S. G. Blaylock, Trail, B. C., is general manager of the Consolidated Mining and Smelting Co. of Canada, not **E. J. Montgomery** as mentioned in the *Journal,* Sept. 4, in the article "Microscopic Features of Sullivan Ore." Mr. Montgomery is local superintendent at Kimberley.

P. P. Butler superintendent of the Copper Queen smelter at Douglas, Ariz., has tendered his resignation to the Phelps Dodge Corporation, due to ill health, and **J. Owen Ambler** at present superintendent of the Phelps Dodge smelter at Clifton, Ariz., will be transferred to Douglas in Mr. Butler's place.

J. A. Dunn, assistant superintendent of the Geological Survey of India, has had conferred on him the degree of doctor of science by the University of Melbourne, Australia. He is now on leave in Australia for eight months, and represented the government of India at the Perth (Western Australian) meeting of the Australasian Association for the Advancement of Science.

Charles R. Fettke and W. A. Copeland of the Carnegie Institute of Technology, who have been making a detailed geological survey of the Bradford Quadrangle for the Pennsylvania Topographic and Geologic Survey, have returned to Pittsburgh. Field work will be continued next summer. The different methods of oil recovery at present employed and the results obtained are also being studied.

Obituary

E. D. Nolan, chief geologist of the General Petroleum Co., died in San Francisco, Calif., Sept. 5. Mr. Nolan was a graduate of Leland Stanford University. Although but 36 years old, he had achieved high respect as a geologist among members of his profession. Experience in South America, the West Indies, Alaska, Mexico, and western states had given Mr. Nolan a knowledge acquired by few young men.

Charles Ballard, born in London, Eng., in 1851, and associated with A. W. Geist as early as 1875 in the silver-lead smelting industry at Cottonwood Canyon, near Salt Lake City, died by a paralytic stroke at Long Beach, Calif., Sept. 3, 1926. After leaving Utah he was associated with Mr. Geist at the Pueblo Smelter, Colo., as referred to by E. P. Mathewson in his "Reminiscences of Smelting at Pueblo." Here he was in the capacity of accountant and financial assistant and was well and favorably known to smelter men there and elsewhere. Later he was in the employ of the Guggenheim and of the Trona Corporation in California, then under charge of Baron Von Rupp. Mr. Ballard leaves a wife and three grown children at Long Beach, Cal.

Recent Technical Publications

Reviews, Abstracts, and References

Applied Geophysics

Methoden der angewandten Geophysik. (Methods of applied geophysics.) By Dr. R. Ambronn. Verlag von Theodor Steinkopff, Dresden and Leipzig, Germany.

Physical instruments and methods for finding useful mineral deposits gain a steadily increasing range of application in mining. Various articles which have been published recently in the *Engineering & Mining Journal-Press* are a a good testimony of the interest the modern mining engineer pays to this new science of "applied geophysics." It has become an important aid in reducing the high expense of prospecting by geological methods only.

Since the science of applied geophysics employs not only one, but various principles of geophysics, it is very broad in nature and closely connected with numerous other special sciences, as for instance seismology, terrestrial magnetism, geodesy, radioactivity, and electrodynamics. For somebody who wanted to concern himself with the science of applied geophysics, especially from the viewpoint of the mining engineer, it was necessary to study all the publications of the other sciences mentioned, frequently even not knowing where to find them since they are scattered in journals of quite various nature.

Therefore, there was a rather keen want of a book dealing with the subject in a comprehensive way and this one of Dr. Richard Ambronn of Goettingen, Germany, appeared just in time to meet an urgent demand. It is startling how much material has been compiled in only about 200 pages. The author has confined himself to an exhaustive description of the fundamental principles of the methods in question and of the success obtained so far according to previous publications on the subject which he had collected for years and combined in a reference list at the end of this book. This bibliography contains about 1,600 articles.

Of course, there would have been perhaps another possibility of writing a book on applied geophysics; I mean, something like a textbook giving a mathematical theory of the methods, and instructions how to handle the various instruments and draw conclusions from the results as regards to subsurface geology. But the time has not yet come for that. First, the science of applied geophysics is very young and only at the beginning of its development. Second, unfortunately the accomplishment of geophysical measurements for practical geology has been for years in the hands of numerous private exploration companies or engineers—in America not less than about a dozen—which all are going their own way and do not let the public have the benefit of their experience, so that the scientist who wants to write anything about geophysical methods which he did not happen to carry out himself is unable to do so except by taking the laborious way of building up his knowledge in other methods himself from the very beginning.

As I said before, Dr. Ambronn's book meets all requirements which can be demanded at present from a book of that type and avoids the difficulties characterized above in a very fortunate way. There is not enough space at my disposal to give a detailed description of its contents. Here follows a brief statement of the various chapters: Methods for determining gravity (pendulums, torsion balances, plumb-line deviations, isostatics); magnetic measurements (local and temporal variations of the earth magnetic field, instruments for magnetic prospecting); radioactive measurements; electrical prospecting; seismology and methods using artificial earthquakes; geothermal measurements. Very valuable in connection with the various chapters are tables giving specific gravities, susceptibilities and electric conductivities of rocks. Sketches demonstrating actual success of geophysical measurements in mining problems are given on page 45 (torsion balance measurements above a salt dome in Northern Germany); page 46 (torsion balance measurements below the surface in a salt mine and torsion balance measurements above a siderite dike in Westphalia); page 81 (measurements of the magnetic horizontal intensity above a serpentine dike in Hungary); page 83 (magnetic measurements over a magnetite deposit in Saxony, and magnetic vertical intensity above salt domes in Northern Germany); page 100 (radioactivity curves across a hematite dike in the Hartz Mountains); page 123 (lines of equal spontaneous potential of a pyrite deposit in France); and page 141 (equipotential lines derived from electric measurements above copper deposits in Sweden).

DR. C. A. HEILAND.

Canadian Mining—Summary Report of the Canadian Geological Survey for 1924, Part C, contains the following papers: "Eastern Part of Matawin Iron Range, Thunder Bay District, Ontario," pp. 27, by T. L. Tanton; "Gunflint Iron-bearing Formation, Ontario," pp. 61, by J. E. Gill; "Mineral Deposits of Rutter Map-area, Sudbury District, Ontario," pp. 7, by T. T. Quirke; "Limestone on Abitibi and Mattagami Rivers, Ontario," pp. 3, by Wyatt Malcom; "Clericy and Kinojevis Map-areas, Témiscamingue and Abitibi Counties, Quebec," pp. 27, by W. F. James and J. B. Mawdsley; "Barraute Area, Abitibi County, Quebec," (map); "Shickshock Mountains, Central Gaspé, Quebec," pp. 7, by F. J. Alcock; "Geology of Mount Serpentine, Gaspé, Quebec," pp. 8, by F. J. Alcock; "Carboniferous Formations of Northumberland Strait, Nova Scotia," pp. 39, by W. A. Bell; "Chemistry of the Potash-bearing Horizon of the Malagash Salt Deposit, Nova Scotia," pp. 18, by H. V. Ellsworth; "Geology and Ore Deposits of Stirling Area, Richmond County, Nova Scotia," pp. 19, by L. J. Weeks; "Investigation of Peat Bogs in Nova Scotia," pp. 22, by A. Anrep; and "Deep Borings in Ontario, Quebec, and Maritime Provinces," pp. 7, by E. D. Ingall. Copies are obtainable from the Canadian Geological Survey, Ottawa.

Victoria Geology—The Victoria Department of Mines has recently issued the following bulletins: Bulletin No. 44, Geological Survey of Victoria, "Bright, Wandiligong, and Freeburgh Gold-Fields," by J. P. L. Kenny, pp. 64 with accompanying plates, price 1s. 6d. from the Department of Mines, Melbourne, Victoria; "Records of the Geological Survey of Victoria, Vol. IV, Part 4," describing briefly many different districts, price 1s. 6d.; and Memoir No. 15, on "The Aberfeldy District, Gippsland," by W. Baragwanath, and an "Appendix on Petrology," by D. J. Mahony, pp. 45, with accompanying plates and colored maps, price 3s.

Mining Methods—The August issue of *The Mining Congress Journal* (Washington, D. C.; price 30c.) contains the following papers on mining methods: "Mining Methods in the Butte District," by H. J. Rahilly, pp. 4, and "Mining Methods at Portland Mine," by J. W. Ady, Jr., pp. 3.

Mine Ventilation—The Aug. 20 issue of *Engineering* (London; price 1s. 3d.) contains an article, with numerous drawings and photographs, descriptive of the mine ventilating surface equipment of the Government Gold Mining Areas, Modderfontein, South Africa. This has been in use about a year. The fan and engine are designed to give at maximum load, a discharge of 900,000 cu.ft. of air per minute under a pressure of 7 in. of water.

Canadian Minerals — The Canadian National Railways has issued an attractive illustrated booklet entitled "Maps and information issued as aids to the development of the Mineral Resources along the Canadian National Railways in north-eastern Canada." The publication is well arranged to entice the visitor to the mining regions of eastern Canada. All of the newer mining districts are given attention, the current issue being a revision of that of 1925. Copies are obtainable on request from the Superintendent of Development, C. N. R., 1 Toronto St., Toronto, 2, Ont.

Uganda—The annual report of the Geological Survey Department, of Uganda Protectorate, for 1925 has recently been issued, and may be obtained from The Director, Geological Survey, Entebbe, Uganda, Africa.

Alaska—Three sections of Bulletin 783 have recently been published by the U. S. Geological Survey, Washington, D. C., as follows: No. 783-B, "Mineral Investigations in Southeastern Alaska," pp. 22, by A. F. Buddington; 783-C, "Geology and Oil Developments of the Cold Bay District, Alaska," by Walter R. Smith, and "A Ruby Silver Prospect in Alaska," by S. R. Capps and M. N. Short, pp. 32; 783-D, "The Nixon Fork Country and Silver-Lead Prospects near Ruby," pp. 54, by John S. Brown; and 783-E, "Summary of Recent Surveys in Northern Alaska," pp. 18, by Philip S. Smith, J. B. Mertie, Jr., and W. T. Foran. These bulletins may be obtained from the Survey free of charge.

New Machinery and Inventions

Columbia Variable-Speed Transmission

A type of variable-speed transmission unit, which permits of minute adjustments of speed over a wide range, has been brought out recently by the Columbia Vari-Speed Co., 4020 West Lake St., Chicago, Ill. Fig. 1 shows a general view of the unit, while the section Fig. 2 shows the constructional features.

Power is transmitted in the unit by means of the traction between the hard metal surfaces of the rollers and races bearing against each other under high pressures. There are three rollers, *A*, which instead of being cylindrical, are tapered from the center toward each end, the profiles of the tapered sections being circular arcs. When the machine is in operation, the rollers move in planetary fashion about its axis, rolling around the inside of the two outer races *B* and *C* and around the outside of the two inner races *D*. The two outer races are secured against rotation, while the inner races are rotated by the input or constant-speed shaft *S*. Each roller is mounted in a yoke *G* and the yokes are carried on each of the three projecting shafts of spider *M*.

Provides for Speed Variation

The spider is therefore pulled around after the rollers as they move through their circular path between the races, and the output or variable shaft *R*, to which the spider is keyed, is thus rotated. The rollers will necessarily turn shaft *R* at a slower speed than that of the inner races, but the ratio of the speed of the inner races to that of the rollers depends on where the points of contact occur between the rollers and races. Thus, in order to vary the ratio of speeds between the input and output shafts, provision is made for shifting these points of contact. The manner in which the points of contact move in relation to each other is illustrated by the diagrams shown at the left of the sectional view.

In order to change the relative positions of the parts, the outer race *C* is mounted in a sliding frame *J*. It is made to move along the axis of the machine by turning the control wheel *O*. As the space between the outer races widens, the rollers are forced outward by the springs *E* which also cause the traction between the rollers and races.

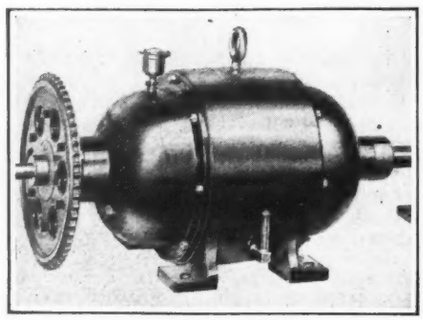


Fig. 1—Exterior view of unit

This transmission is unusually small in comparison to its power. Thus a 3-hp. unit takes up less than 1 cu.ft.

The shaft *H*, on which are mounted the inner races together with the springs, forms a floating unit which is flexibly connected to the shaft *S* by the pins *I*. The ball thrust bearing *L* is placed behind the flange of sleeve *K* to facilitate turning the control wheel.

Lubrication is effected by partly filling the casing with oil. The oil is thrown outward by the revolving rollers and is led to all working parts through a system of passages.

To meet the requirements of practice, a range such that the maximum speed is about equal to five times the minimum has been found sufficient, and standard units are designed to have this range. Any speed between these limits can be obtained by simply turning the control wheel. In cases where large reductions of speed are desired, gears are included within the housing.

Advantages claimed for this type of unit in addition to high efficiency are ready adjustment of speeds over a wide range, noiseless and vibrationless running at high speed, and small space required per unit of power delivered, a 3-hp. unit requiring less than a cubic foot of space.

There are many cases around the mines where different speeds are desired. Such a unit as the transmission here described will fill this need within its capacity range.

A New Electric Flow Meter for Gas Analysis

The new portable electric CO_2 meter made by the Bacharach Industrial Instrument Co., Homewood Sta., Philadelphia, Pa. consists of a precision profile indicator at the top, below which is arranged, from left to right, the bridge zero adjuster, a tumble switch and the variable resistance for current adjustment. To set the proper bridge current, the tumble switch is thrown into the upper position. This cuts the precision indicator into the circuit as an ammeter and the current is set to the top mark deflection by means of the variable resistor. Three standard dry cells are used as the current source and connected to the two binding posts in the lower left-hand corner. When making temperature measurements, the tumble switch is thrown into the downward position. Any standard thermocouple can be connected to the lower right hand terminals and the reading made on the millivolt scale.

For the analysis of flue gas the tumble switch is thrown into the center position. The gas is sampled by means of a hand aspirator which draws the gas through a small calcium chloride and cotton filter. The instrument is guaranteed to have an accuracy of one-half of one per cent CO_2.

The instrument can also be arranged to give continuous indications for short periods (two to three hours).

The advantages of this instrument over an Orsat or similar analyzing equipment are: A chemist or expert operator is not necessary; no liquids are required; the CO_2 is indicated instantaneously; a large number of tests can be made in the same time that it takes to make one Orsat determination; it can be installed to function continuously for short periods without an operator.

Trade Catalogs

Voltmeters. The Bristol Company, Waterbury, Conn., has issued its Electrical Catalog No. 1052, voltmeter section, containing 24 pages.

Hoists. Bulletin 1819-A of the Allis-Chalmers Manufacturing Co., Mining Machinery Division, is devoted to electric hoists.

Belt Drive. Description of the "Belt-Slacker," a short slack belt drive, is given in a folder issued by the maker, Harry M. Perry, 702 N. Main St., Los Angeles, Calif.

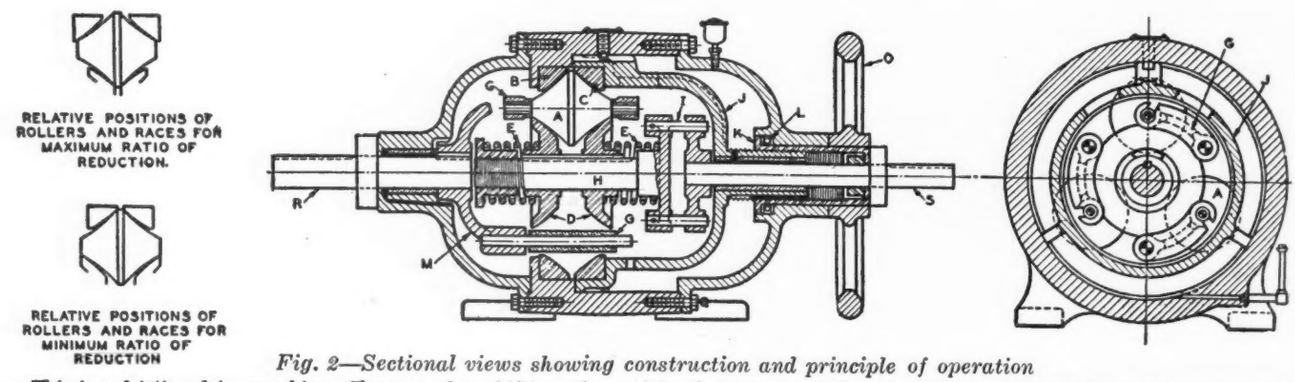


Fig. 2—Sectional views showing construction and principle of operation

This is a friction-drive machine. Changes in speed through wide limits are secured by shifting the point of contact of the races upon the cones. This can be done from the outside of the machine by simply turning a handle wheel.

The Market Report

Copper Active Today; Zinc Quieter

Metal Sales Generally Less than Last Week and Prices Taper Off—Lead, Silver and Tin Weaker

New York, Sept. 22, 1926—The week ending today has not been a particularly brilliant one for any of the nonferrous metals though heavy and well-distributed purchases of copper by one company today have taken some of the cheap offerings off the market. Prices on all of the more important metals have tapered off slightly, though lead has almost held its own.

Copper at 14 ¼c., Delivered

The comparatively heavy buying of copper reported in last week's issue proved to be temporary; little or no interest has since been taken by consumers until today when one large consumer entered the market heavily and picked up a good tonnage on the basis of 14¼c. delivered in the East. Previously a few small orders had been booked to other consumers at 14.30@14.325c., delivered in the East and a little was also sold at 14.425c., delivered in the Middle West. One seller only, was active throughout the week, and was compelled to sell Connecticut consumers at 14¼c., delivered, to effect the desired business. This price applied on all deliveries from September to December, and some good forward orders were booked, but in general, consumers were disinclined to buy except for immediate requirements and in small lots. It would appear that less copper is now bought ahead than at any time in recent months and should deliveries be interrupted from any cause, some consumers might be in trouble. Knowing this, sellers are not disposed to cut prices further to effect sales, they feeling that buying must soon develop. They also feel that the official announcement of the formation of the Copper Export Association, which is expected in two or three weeks, will be a strengthening influence.

The foreign market has been a little better; American agencies reduced their prices to 14.45c., c.i.f., on Monday.

Daily Prices of Metals

Sept.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
16	14.025	69.00	71.00	8.75	8.50	7.425–7.475
17	14.025	68.00	70.50	8.75	8.50	7.45
18	14.025	67.875	70.375	8.75	8.50	7.425
20	14.025	67.625	70.125	8.75	8.475@8.50	7.425–7.475
21	14.025	67.50	70.00	8.75	8.50	7.40 –7.425
22	14.025	66.75	69.125	8.75	8.45	7.375–7.425
Av.	14 025	67.792	70.188	8.750	8.490	7.431

The prices correspond to the following quotations for copper delivered: Sept. 16th to 22d, inc., 14.275c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
16	58½	59⅜	66½	316½	304	32 7/16	31 15/16	34 7/16	34 7/16
17	58¾	59½	66½	313½	303	32 5/16	31 15/16	34 9/16	34 9/16
20	58¾	59½	66½	312	301	32 3/16	31 15/16	34 11/16	34 11/16
21	58¾	59½	66½	311½	302	32 3/16	31 15/16	34⅝	34 9/16
22	58⅞	59¼	66¼	305½	299½	31 15/16	31 13/16	34½	34⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
16	4 84⅞	61⅜	28⅛	84s11½d	20	4 84⅞	60½	27 13/16	84s11½d
17	4 84⅞	61¼	28⅛	84s11½d	21	4 84¾	60½	27 13/16	84s11½d
18	4 84⅞	60¾	27 15/16		22	4 84⅞	60⅜	27 13/16	84s11½d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Lead Quiet and Easier

Although the business done during the week ending today has been larger than that of the preceding period the domestic lead markets may still be described as quiet. The American Smelting & Refining Co. continues its contract price in New York at 8.75c. per lb. and until today the leading interest in the St. Louis district has been quoting on a basis of 8.50c. A reasonably large supply at 8.45c., some even as low as 8.425c., appears to be available, however, and the important producers are willing to meet the first figure mentioned. With the exception of a very limited quantity in the hands of dealers few sales have been made in New York below the official price of the Smelting company. Although the London market has declined slightly, the price over there is amply high to assure the consignment of Mexican bullion lead to European destinations for the time being. Some domestic buyers, particularly "blue lead" manufacturers, are not buying just now. Their feeling is that the reduction made by the Smelting company a week ago is more likely to be followed by further declines than by an increase. The lead market, it is true, is not given to quick reversals in trend. This expectation of cheaper metal rather than any serious curtailment of manufacture is the reason for the lack of buying. Cable manufacturers, battery makers, and corroders appear to be buying at normal rates.

Zinc Slightly Weaker

Zinc prices held fairly steady until the last two days, when the lull in buying caused producers to shade prices

to some extent. The metal is freely offered today at 7.40c., with bids at 7⅜c. Most of the business has been for either September or October shipment; all shipments are quoted at the same price. Brass Special has sold at 10 points premium, and High-Grade continues at 9c., delivered in the East.

Tin Reaches 71c.; Declines

Straits tin for prompt delivery brought 71c. in New York last Thursday, thereby establishing another high record for the last six years. Since then it has declined steadily to 69¼c. A break of £6 in the price of prompt Straits in London today indicates a change in position on the part of speculative interests abroad. Consumers in the domestic market who normally buy by the carload have in many instances taken 5- or 10-ton lots, dealers and speculators doing the bulk of the buying. Forward prices are 2 to 2¼c. less than prompt.

Foreign Exchange Steady

Closing cable quotations in the principal foreign exchange markets on Tuesday Sept. 21 are exactly as they were a week ago, as shown below: Francs, 2.8675c.; lire, 3.605c.; and marks, 23.82c. Canadian dollars, ¾ per cent premium.

Silver Down to 60⅜c.

Weakness in Chinese exchanges, with sales by China and India, have further depressed silver, the New York price establishing a new low for the year today at 60⅜c. The market closes steady.

Mexican Dollars: (Old Mexican Pesos): Sept. 16th, 46⅝c.; 17th, 46½c.; 18th, 46¼c.; 20th and 21st, 46¾c.; 22d, 46c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Both 98 and 99 per cent grades quoted at 27c. per lb. London, £118 per long ton for domestic metal.

Antimony—Per lb., duty paid, New York; Chinese brands, spot, 16@14⅞c.; November 14½c.; December 14c. Improved transportation facilities in China have eased the market. Cookson's "C" grade, 18@18¼c. Needle and oxide nominally unchanged from quotations in the Sept. 4 issue.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c. London, 1s. 10½d. for American metal; 1s. 9d. for Australian metal.

Iridium—Per oz., $125@$135 for 98 @99 per cent. Firm. London, £63@ £65 in iridio-platinum.

Nickel—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. **(99.75 per cent grade).** London, £170@£175 per long ton according to quantity.

Osmium—Per oz., $55@$65. London, £17@£20.

Palladium—Per oz., $66@$70. Pure metal as a constituent of crude platinum, $50@$55 per oz. London £12@ £15, nominal.

Platinum—Official price on refined metal, $118 per oz. Open market cash sales of large lots, $112@$113. Pure metal as a constituent of crude platinum, $109@$110.

London, £23½ per oz. for refined and £21@£22 for crude.

Quicksilver — Per 75-lb. flask, $91 @$93. San Francisco wires $90.33; steady. London, £16½.

The market has stiffened as a consequence of the purchase of the Spanish output for 1926 and 1927 by a strong syndicate at a price reliably reported as £14 per ton at the mines.

Ruthenium—Per oz., nominally $50@ $60.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the issue of Sept. 4.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N. Y.: Wolframite, $10.50@$10.75; Western scheelite, $11@$11.25.

Chrome, Iron, Manganese, Molybdenum, Tantalum, Uranium, and **Vanadium Ores** are unchanged from quotations in the Sept. 4 issue.

Zinc Ore Up; Lead Down

Joplin, Mo., Sept. 18, 1926

Zinc Blende	Ton
High	$48.87
Premium blende, basis 60 per cent zinc	$51.00@$52.00
Primes Western, basis 60 per cent zinc	$50.00@$51.00
Fines and slimes, 60 per cent zinc	$49.00@$46.00
Average settling price, all zinc	$48.87
Galena	
High	$115.50
Basis 80 per cent lead	$112.50@$110.00
Average settling price, all lead	$112.15

Shipment for the week: Blende, 19,-682; calamine, 32; lead, 3,029 tons. Value, all ores the week, $1,302,860.

Three buyers advanced the basis price of prime western grades of zinc ore $1 per ton today, to fill orders, sellers holding for a higher price level. Buyers purchased less than 13,000 tons on the basis offerings that have prevailed several weeks. Heavy rains have flooded some mines with water.

Two buyers of lead dropped price offerings today to $110 basis, but one buyer reports his purchases on $112.50 basis.

Platteville, Wis., Sept. 18, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$52.75
Lead Ore	
Lead, basis 80 per cent lead	$112.50

Shipments for the week: Blende, 1,161 tons; lead, none. Shipments for the year: Blende, 39,577; lead, 1,446 tons. Shipments for the week to separating plants, 2,180 tons blende.

Non-Metallic Minerals

Fluorspar—In *New Mexico;* 85-5 gravel, $16 per ton; lump, $16.50; ground, 100 mesh, $35. Market good. Other fluorspar prices unchanged from Sept. 4 issue.

Magnesite—Per short ton, f.o.b. California mines, grade "A" calcined, 80 per cent through 200 mesh, white, for plastic purposes, $45 per ton. Market fair.

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Sept. 4 issue.

Mineral Products

Arsenious Oxide (White Arsenic)—3½c. per lb. Demand continues fair but prices show no change. London, £13 per long ton.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and **Zinc Oxide** are unchanged from prices in the Sept. 4 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $88@$95 per long ton, furnace, prompt and future. Spiegeleisen unchanged from Sept. 4 issue.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from prices in the Sept. 4 issue.

Metal Products

Rolled Copper—Per lb., sheets, 23c.; wire, base price, 16¼c.

Lead Sheets, Nickel Silver, Yellow Metal, and **Zinc Sheets,** are unchanged from the prices in the Sept. 4 issue.

Refractories

Chrome Brick—$50 per ton, f.o.b. shipping point.

Magnesite Brick—$65@$70 per ton for 9-in. straights, f.o.b. works.

Silica Brick—$43 per M, *Pennsylvania* and *Ohio;* $52@$55, *Alabama* and *Illinois.*

Fireclay Brick and **Zirkite** are unchanged from quotations in the Sept. 4 issue.

Steel Market Firm

Pittsburgh, Sept. 21

The turnover in the steel market has been running approximately the same thus far this month as in August, with slight changes in different lines which more or less balance each other. Production of steel thus far this month holds practically to the August rate, which represented about 86 per cent of assumed capacity, that being also the average rate since Jan. 1.

Steel prices remain firm. There is no softening visible in any direction, while in the case of sheets prices have been stiffening, partly through recent changes in the quoting system. Some eight or ten mills have advanced their asking prices, on the new system, evidently being well sold up.

Pig Iron—Although there is somewhat more inquiry for foundry pig iron the Valley market in general remains dull. Bessemer, $18@$19; basic, $17.50; foundry, $17.50@$18, f.o.b. Valley furnaces.

Connellsville Coke—Spot furnace coke holds at $3.25@$3.35 fairly well despite the lightness of inquiry. Spot foundry, $4@$4.50.

Company Reports

Castle-Trethewey Mines, Limited

Silver; Bestel, Ont., Canada

The fifth annual report of Castle-Trethewey Mines, Ltd., for the fiscal year ended June 30, 1926, shows a net profit, before depreciation, of $274,323. Provision for depreciation and sundry adjustments amounted to $51,339, leaving a balance of $401,521 carried to the balance sheet, including the balance of $178,536 carried forward last year.

During the year the mill treated 34,425 tons of ore, recovering 29.03 oz. per ton, or a total of 999,234 oz. of silver. Ore reserves were increased by approximately 161,000 oz. of silver (from 2,540,000 to 2,701,000) now contained in 86,600 tons of an average grade of 31 oz. Operations have been greatly facilitated since ample power was made available by the completion of the Northern Canada Power Co's. transmission line into the property last March. Only a limited portion of the property is yet under development, and intensive exploration in other areas is planned.

The concentrating mill on the property, in the Gowganda district of Ontario, produced 323.25 dry tons of concentrates averaging 3,091 oz. of silver per ton. Silver prices averaged 67.89c. per oz., the revenue from the silver being $657,843. Also, 30,879 lb. of cobalt was contained in the concentrates, valued at $5,314, the total revenue thus being $663,158. Total development footage amounted to 7,465 ft. The total footage of drifts, raises, and winzes was 5,820 lineal feet, of which 24.6 per cent was in ore. Diamond drilling amounted to 1,102 lineal feet.

Operating costs based on the 34,425 tons milled, and 999,234 oz. of silver produced, were as follows. The mine produced 40,534 tons and the dump, 1,254 tons. Of this total, 7,363 tons was sorted out as waste before milling:

Operating Costs

	Per Ton Milled	Per Oz. Silver
Development	$4.218	0.145
Mining	2.117	0.073
Tramming and hoisting	0.893	0.031
Milling	1.946	0.067
Shipping	0.290	0.010
Smelting and refining	0.776	0.027
General expenses—mine	0.439	0.015
Corporate, legal, and head office	0.547	0.019
General maintenance	0.163	0.006
Insurance and miscellaneous	0.142	0.005
	$11.531	$0.398

The development footage has been raised from 400 to 1,000 ft. a month as the nature of the ore deposits in this field makes it essential to carry out a large volume of cheap development constantly. One of the most pleasing developments of the year was the opening up of splendid ore on the 625-ft. or bottom level of the mine. In a limited amount of development there, 250 lineal feet of 50- to 60-oz. ore has been opened up over a width of 60 in. "The future of the property is assured and most promising."

The capital stock issued amounts to 2,000,000 shares, $1 par. The $200,000 preferred stock has been redeemed. J. P. Bickell is president; J. B. Tudhope, vice-president; Balmer Neilly, secretary-treasurer; and H. G. Young, manager. The head office is at Toronto.

Vipond Consolidated Mines, Limited

Gold; Timmins, Ont., Canada

The fourth annual report of the Vipond Consolidated Mines, Ltd., for the fiscal year ended July 31, 1926, states that the mine and mill, at Timmins, in the Porcupine district of Ontario, were in continuous operation during the year and produced bullion to the value of $565,995, representing a recovery of $8.77 per ton from the 64,522 tons milled. The cost of production amounted to $490,515, leaving a profit from operations and miscellaneous earnings, of $81,214 before writing off depreciation for this year and development charges carried forward from previous years. The increased operating expense is due to an increase of $55,000 in the cost of mine development. During the year the mill was enlarged at a cost of $75,986, its present capacity being 300 tons a day. Improvements to the mining plant absorbed $9,638. Both of these expenditures were met out of current operating revenue. In July, with the enlarged mill, 7,404 tons were treated and the costs dropped to $6.04 against $7.60 during the year under review, and $7.84 in the previous year.

In the underground operations, 7,643 ft. of drifting and crosscutting was done at a cost of $12.28 per foot; 1,359 ft. of raising, costing $16.43 per foot; and 39.5 ft. of sinking, at $146.12 per foot. Ore hoisted amounted to 64,676 tons, of which 46,299 tons were taken from the stopes. The cost per ton delivered to the primary crushing plant was $2.48. A total of 15,306 ft. of diamond drilling was done at a cost of $1.61 per foot.

The average assay value of the 64,522 tons of ore milled was $9.74, recovery being 90.2 per cent. The cost of production was divided as follows:

Development	$2.36
Ore extraction	2.48
Crushing, conveying, and milling	1.37
Shipping and marketing bullion	0.08
General camp maintenance	0.19
Administration at the mine	0.46
Head office expense	0.09
Corporate expense	0.28
Taxes	0.02
Insurance	0.27
Total	$7.60

Ore reserves are estimated at approximately 300,000 tons, of a total assay value of $2,475,000. Of this amount, 55,000 tons, of an assay value of $520,000, is broken.

The company has authorized and issued capital stock amounting to 2,000,000 shares, at $1 per share, par value. The head office of the company is at 302 Bay St., Toronto. F. H. Hamilton is president; John H. Black, vice-president; J. Mackintosh Bell, managing director; and R. S. Dening, secretary.

Belgian Zinc Smelters Apprehensive Over Increasing Electrolytic Production

In his monthly statement of world conditions in the zinc industry, dated Sept. 1, A. J. M. Sharpe, foreign correspondent of the American Zinc Institute reports as follows:

September has opened quietly from a market point of view, and it is doubtful whether there will be any real liveliness until the prolonged coal strike in Great Britain is over. Undoubtedly, the back of the strike has been broken, and with the near approach of winter it becomes imperative for the union leaders to make the best terms possible for a settlement. The crisis is now on its last legs, and it will surprise everyone if the dispute is not settled during the current month.

Meanwhile, the British zinc industry remains entirely closed. The twenty tons reported to have been produced in August were obtained from experimental work. It will be at least a month after the coal miners return to work before the zinc smelters can attain full operation. Fair stocks of Australian concentrates exist, and to prevent any undue accumulation and locking-up of money the bulk of the arrivals has been turned over to the Belgian smelters. Thus, the ore supply has been superabundant, a factor which has influenced a hardening in the returning charge and the practical cessation of imports of ore from the Tri-State field.

The Belgian zinc industry has attained its pre-war scale of production, and the main concern in that country today is its ability in the years to come to compete successfully with the ever-increasing output of high-grade metal produced by the electrolytic and electro-thermic methods of treatment. High-grade 99.9 per cent is becoming increasingly popular, as its premium over the selling price of common zinc lessens. The premium has steadily come down from £3 a long ton a few months ago to £1 17s. 6d., and as it becomes necessary to place larger quantities so will the spread between the two grades contract, in my opinion. Belgian zinc interests are, not unnaturally, somewhat apprehensive of this cheaper method of producing metal, which they are unable to employ through lack of hydro-electric power in their own country. For this reason, we may be assured that the Belgians will leave no stone unturned in

improving their distillation practice, and at the same time keeping *au fait* with the trying-out of the new metallurgical processes.

Consumption in Europe is well maintained and highly encouraging having regard to the disturbed political and economic situation. The galvanizing trade keeps busy and the rollers are heavily occupied.

I estimate world stocks of zinc on Sept. 1 as follows:

	Metric Tons
United States	16,500
Canada	2,400
Australia, including shipments afloat	2,200
Germany and Poland	5,500
Belgium	2,000
France	1,000
Great Britain	1,400
Scandinavia	200
Far East	500
Elsewhere	1,500
Total	33,200

Pessimistic on Silver Outlook

Samuel Montagu & Co., of London, in their bulletin of Sept. 8, say that the movements of the price of silver of late would seem to show that the market, in spite of temporary resilience, has lost the power of remaining at the quotation level of the last few years. With a large body of speculative operations and with the chance of fresh speculative factors intervening one way or the other, a tranquil market can hardly be anticipated. Fluctuations, unexpected and sharp, up or down, are more likely to occur. The ability of bears to maintain their position may be tested by attempts to corner deliveries, especially in India. American producers have lost their usual optimism—and rightly so—and they have begun to gauge the real condition of the silver market, and this must be reckoned as a factor. For instance, the following extracts appear in the *Bulletin* of the U. S. Mining Congress:

"Silver men claim that the outlook for production is worse than at any time within the last fifty years and that unless some practical remedy is obtained, producers will face harder times. . . . Some of the larger silver producers feel that the situation can be solved if there can be brought about an increased consumption of silver in the arts and as subsidiary coinage. Consideration has been given to an advertising campaign to popularize the use of silver plate and to replace in foreign countries paper money with silver coins. It is expected that the silver producers will map out a programme to create a natural demand for silver."

Mocatta & Goldsmid, in their bulletin of Sept. 9, are also pessimistic on silver. "In view of the enormous stocks in Shanghai as well as in London," they say, "and the small demand there is likely to be for India, the outlook is not very encouraging and although about the present level may be maintained for a time we have a poor opinion of the distant future."

The East Indian custom of putting surplus wealth into gold and silver has taken enormous amounts of these metals but hoarding of gold in India is coming to be less widely practiced than in years past and millions of dollars in gold rupees are being brought out of their hiding and converted into securities, according to reports reaching the Regional Division of the U. S. Department of Commerce. During the past year, reports say, an unusual amount of capital has been available and the money market at present is easier than it has ever been before. The usual strain for funds around crop growing time is not expected to be felt in most parts of India this year.

"This abundance of capital," says the division, "suggests that more and more treasure is being brought out from hiding and is deposited in banks or invested in securities. Not long ago it is stated that a wealthy Arab converted a hoard valued at $350,000 into Government of India securities. In all parts of India reports indicate that there is a steady conversion of hoarded rupees into investments."

In some sections hoarding continues much as it did a century ago, although probably on a much smaller scale, the reports say. "It was originally founded on economic necessity," it is stated. "If the monsoon failed, either wholly or partially, disaster was certain to follow unless the native could draw on his hoarded gold or silver, as the farmer in a more progressive country would draw upon or borrow from his bank."

The tendency to invest in securities may augur well for the prosperity of the natives but it will not add to the prosperity of precious-metal producers. However, according to the Hindu inheritance laws a widow can only inherit what she wears, and it is therefore the aim of every wife to possess and wear as many ornaments as her husband can afford, these ornaments being of gold in the case of wealthy people and silver when circumstances are less favorable. But possibly negotiable securities can be sewn into the linings.

Mining Dividends Again Increase This Month

The following dividends were paid by American mining and metallurgical companies in September:

Companies in the United States	Situation	Per Share		Total
American Metal	U. S. and Mex.	$1.00	Q	$593,453
American Metal pfd	U. S. and Mex.	1.75	Q	87,500
American Smelting & Refining pfd	U. S. and Mex.	1.75	Q	875,000
Bingham Mines, s,l	Utah	1.00	Q	50,000
Butte & Superior, z,s	Mont.	.50	Q	145,099
California Rand Silver, s,g	Calif.	.01	M	12,800
Calumet & Arizona, c	Ariz.	1.50	Q	964,135
Calumet & Hecla, c	Mich.	.50	Q	1,002,751
Eagle Picher Lead, z,l	Okla., Mo., Kans.	.40	Q	400,000
Federal M. & S. pfd., s,l,z	Ida., Okla.	1.75	Q	210,000
Gladstone Mountain, l	Wash.	.005	M	6,609
Hecla Mining, l,s	Idaho	.50	Q	500,000
Homestake Mining, g	S. D.	.50	M	125,580
Inland Steel	Minn.	.625	Q	739,249
International Nickel, n,c	Ont., W. Va.	.50	Q	836,692
Mohawk Mining, c	Mich.	1.00	Q	115,000
National Lead	U. S.	2.00	Q	413,108
National Lead pfd	U. S.	1.75	Q	426,433
Nevada Consolidated Copper	Nev., Ariz., N.M.	.25	Q	499,864
Ohio Copper	Utah	.05		144,977
Republic Iron & Steel	U. S.	1.00		300,000
St. Joseph Lead, l,z	Mo., N. Y.	.75	Q	1,452,478
Sloss-Sheffield Steel & Iron	Ala.	1.50	Q	150,000
Tennessee Copper & Chemical	Tenn.	.25	Q	198,650
Texas Gulf Sulphur	Texas	3.00	Q	1,905,000
Tintic Standard, s,l,c	Utah	.40	Q	461,166
Tom Reed Gold	Ariz.	.02	Q	18,191
U. S. Steel	U. S.	1.75	Q	8,895,294
United Verde Copper	Ariz.	3.00		900,000
Utah Copper	Utah	1.25	Q	2,030,612
Companies in other countries				
Chile Copper	Chile	.625	Q	2,744,528
Hollinger Consolidated Gold	Ont.	.10	4 wks.	492,000
Keeley Silver	Ont.	.12	SA	240,000
Lake Shore, g	Ont.	.10	Q	200,000
Lucky Tiger-Combination, g,s	Sonora	.07	M	50,074
McIntyre Porcupine, g	Ont.	.25	Q	199,500
				$28,385,748

s, silver; l, lead; z, zinc; g, gold; n, nickel; c, copper; Q, quarterly; M, monthly; SA, semiannually.

Mining dividends continue to increase, the total for September being about $900,000 more than for the previous corresponding quarter, paid in June, and $3,100,000 more than in September, 1925. Ohio Copper made its first payment since last December, at the same rate that was declared at that time. Republic Iron & Steel made its first payment on the common since May 2, 1921, when $1.50 per share was paid. The current distribution is $1 per share and is likely to be made a quarterly dividend. A net profit equal to $2.28 a share was earned after preferred dividends in the quarter ending June 30, and for the first six months of the year, the net profit was equal to $5.22 a share on the common. Profits, therefore, are more than double the dividend. Texas Gulf Sulphur increased its dividend from $2.50 a share to $3. Other companies declared the usual dividends except Inland Steel, which went back to the 62½c. rate, after increasing it to 75c. in June.

Dividend Yields

The dividend yields on the stocks of the above companies that are on a regular dividend basis, based on the September distributions and on recent market prices, are as follows:

Company	Per Cent Annual Yield	Company	Per Cent Annual Yield
Butte & Superior	20.8	St. Joseph Lead	7.3
Gladstone Mountain	19.0	Texas Gulf Sulphur	7.2
Keeley Silver	14.8	Republic I. & S.	6.9
Tintic Standard	13.8	Hollinger	6.8
Tom Reed	12.3	Inland Steel	6.2
Hecla	11.4	American Metal pfd	6.1
Calumet & Hecla	11.2	National Lead pfd	6.0
Homestake	10.1	A. S. & R. pfd	5.9
Bingham	9.7	International Nickel	5.5
Mohawk	9.7	National Lead	5.2
Federal pfd	9.6	Eagle Picher	5.0
Lucky Tiger	9.4	U. S. Steel	4.9
Calumet & Arizona	8.9	Utah Copper	4.8
Tennessee Copper	8.1	Sloss-Sheffield	4.8
American Metal	8.0	McIntyre Porcupine	4.1
Nevada Con.	7.7	Lake Shore	2.9
Chile Copper	7.5	Average	8.5

Current Prices of Mining Supplies

Rise and Fall of the Market

THE new base on one pass cold-rolled black sheets and also on galvanized steel sheets is now 24 Gauge. Slight fluctuation occurred during the month in track supplies at mills. C.-I. pipe is higher than a month ago. Linseed oil and manila rope tend downward. Steel holds firmly at $2 per 100 lb., Pittsburgh, on structurals. Most of the lumber declines are in fir. Pine, however, appears in better demand with scattered advances reported.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.30	$3.60	$3.50	$3.90	$3.89
Black					
No. 24	3.00	4.45	3.95	4.75	4.35
Galvanized					
No. 24	3.85	5.70	4.80	6.00	5.10

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.80–2.90	$2.80	$3.55	$3.65	$4.35	$2.90@3.00
Track bolts	3.90–4.25	3.90@4.15	4.55	4.40	5.85	3.90@4.15
Standard section angle bars	2.75	2.75	3.40	3.25@3.75	3.60	2.75

STRUCTURAL MATERIAL—Following are base prices in carload lots, f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. in less than carload lots, from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.00	$2.00	$3.34	$4.15	$3.25	$3.10	$3.30
Channel, 3 to 15 in.	2.00	2.00	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 6 in., ¼ in. thick	2.00	2.00	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	2.00	2.00	3.34	4.15	3.35	3.10	3.30
Plates ¼-inch thick	2.00	2.00	3.34	4.15	3.25	3.10	3.30

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD	..1 to 3	62	50½	1 to 1½	30	12
LAP WELD	..2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$52.60@53.60	$50.60@51.60	$40.00 base	$49.20@50.20	$47.50	$50.00

NUTS—Semi-finished, ½x½-in., 2c. each. Discount 70% for ⅝-in. and smaller; 65% for ¾-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1112	$0.1162	$0.075	$0.105	$0.07	$0.108	.....
6x12x12	.1667	.1743	.096	.....	.094	.156	$0.252*
8x12x12	.2084	.2179	.135	.205	.128	.244	.312†

* 10x12x12; † 12x12x12

MACHINE BOLTS—½x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to contractors at yards in San Francisco.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago Up to 20 Ft., Pine	Chicago Up to 32 Ft., Fir
3x4 to 8x8	$43.00	$44.00	$41.50	$40.50
3x10 to 10x10	50.00	51.00	47.50	40.50
3x12 to 12x12	57.00	58.00	57.50	40.50

Other Cities	8 x8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$50.00	$48.00†	$50.00	$50.00	$60.00	$57.50†
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Denver	.....	36.25	34.75	34.75	.....	34.75
Minneapolis	42.50	38.25	34.50	.....	45.00	38.25
Kansas City, Mo.	44.50	42.75	.....	.....	59.50	42.75
Philadelphia	54.00	36.00	38.00	45.00	65.00	36.00

*Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$3.05	$3.75	$4.25	$2.93	$4.95
Cut	2.80	....	5.00	5.00	3.15	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.50@2.60
Chicago, f.o.b.	2.10	2.10	2.20
Cleveland, f.o.b.	2.29	2.29	2.39

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel 280-lb. net Common
New York	$18.20	$11.00	$3.50	$2.10@$3.00
Chicago	20.00	18.00	....	2.25

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.87½	$1.08	$0.90	$1.08

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.25	15.75	16.75	17.25
White	15.25	15.75	15.25	15.75

HOSE—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket (net) ..... 74c per ft.

Air—Best Grade
¾-in., per ft. ..... 3 ply $0.37½ 4 ply $0.46

Steam—Discounts from List
First grade ..... 30–10% Second grade ..... 40% Third grade ... 40–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.
Best grade ..... 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–5%
Heavy	30–10%

RAWHIDE LACING
For cut, best grade, 50%, 2nd grade, 60%.
For laces in sides, best, 41c. per sq.ft.; 2nd, 37c.
Semi-tanned: cut, 50%; sides, 41c. per sq ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ¼ in.	$1.05
Rubber sheet	.60
Rubber sheet, wire insertion	.85

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.27	New Orleans	$0.23½
New York	.24	Seattle	.24
Chicago	22½	San Francisco	.22

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.265	$0.2875
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.233	.26
San Francisco	.1625	.1922

FLOTATION OIL—
Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.46

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. works, per lb.	$0.09@.10
Litharge, casks, f.o.b. works, per lb.	.11½
Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb.	18@.22
Calcium carbide, in drums, f.o.b. works, per lb.	.05½@.06

Mining Stocks—Week Ended September 18, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	50⅛	48⅝	49½	Jy.17, Au.23 Q	0.75
Arcadian Consol.	Boston	1	1	1		
Ariz. Com'l	Boston	11⅝	11⅛	11⅛	Jy. 16, Jy. 30	0.50
Calaveras	N. Y. Curb	1⅛	1⅛	1⅛		
Calumet & Arizona	New York	70⅛	68¼	68⅝	Se. 4, Se. 20 Q	1.50
Calumet & Hecla	Boston	18	17⅛	18	Au.31, Se.15 Q	0.50
Cerro de Pasco	New York	70⅛	68⅜	69⅞	Jy. 15, Au.2, Q	1.00
Chile Copper	New York	33⅝	33⅛	33⅛	Se.1, Se.27, Q	0.62½
Con. Coppermines	N. Y. Curb			3⅛		
Copper Range	Boston	17	16⅛	16⅞	May, 1925	1.00
Crystal Copper	Boston Curb	*38	*34	*36		
East Butte	Boston	3¼	3	3	Dec., 1919	0.50
First National	Boston Curb	...	...	*16	Feb., 1919	0.15
Franklin	Boston			*30		
Granby Consol.	New York	32⅞	28⅛	32⅞	May, 1919	1.25
Greene-Cananea	New York	20⅜	19⅞	20⅞	Nov., 1920	0.50
Hancock	Boston	...	...	1		
Howe Sound	New York			41⅛	Jy.1, Jy.15	0.75
Inspiration Consl.	New York	25⅜	24½	24½	Se.16, Oc.4, Q	0.50
Iron Cap	Boston Curb	3⅜	3⅜	3⅜	Jn. 1, Jn. 15	0.50
Isle Royale	Boston	12⅜	12⅜	12⅜	Jn. 1, Jn. 15	0.50
Jerome Verde Dev.	N. Y. Curb	*60	*50	*50		
Kennecott	New York	56⅞	55⅞	56⅛	Sept. 3, Oct. 1 Q	1.00
Lake Copper	Boston	1	*75	*75	June, 1925	0.50
Magma Copper	New York	40⅞	39⅛	39⅛	Oc.1, Oc.15, Q	0.75
Mason Valley	N. Y. Curb	2⅝	2⅜	2⅜		
Mass Consolidated	Boston	*55	*40	*50	Nov., 1917	1.00
Miami Copper	New York	15⅛	14⅞	15	Aug.2, Aug.16 Q	0.25
Mohawk	Boston	42	41	42	Jy.31, Se.1 Q	1.00
Mother Lode Coa.	New York	6	5¼	5⅞	Jn. 15, Jn. 30	0.37½
Nevada Consol.	New York	13⅜	13	13⅛	Oc.14, Nov.16	0.75
New Cornelia	Boston	22⅜	22⅛	22⅜	Au.6, Au.23 Q	0.04
Ohio Copper	N. Y. Curb	*55	*50	*54	Se. 1, Se. 15	0.05
Old Dominion	Boston	17⅞	17	17⅛	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†138	†136		Jun.22, Jy.2 Q	1.50
Quincy	Boston	20½	20¼	20½	Mar., 1920	1.00
Ray Consolidated	New York	14⅜	14	14⅛	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb		...	11⅞		
St. Mary's Min. Ld.	Boston	30⅛	29	29	Ap.17, My.18	2.00
Seneca Copper	New York	...	...	5⅛		
Shannon	Boston	*42	*42	*42	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	6⅝	6⅜	6⅜		
Superior & Boston	Boston	*50	*50	50		
Tenn. C. & C.	New York	12⅛	11	12⅝	Au.31, Se.15, Q	0.25
United Verde Ex.	N. Y. Curb	27⅛	26	26	Oc.16, No. 1, Q	0.75
Utah Copper	New York	104	104	104	Se.3, Se.17 Q	1.75
Utah Metal & T.	Boston	1⅜	1 5/16	1⅜	Dec., 1917	0.30
Victoria	Boston	*50	*50	*50		
Walker Mining	Salt Lake	*67	*67	*67		
NICKEL-COPPER						
Internat. Nickel	New York	37⅜	36⅛	36⅝	Se.7, Se.30, Q	0.50
Internat. Nickel, pfd.	New York	...	...	102	Jy.12, Au.12,	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*32½	*31½	*32½	Jy. 10, Au.10	0.01½
National Lead	New York	158	153	154	Jn. 11, Jn. 30 Q	2.00
National Lead pfd.	New York	116½	116½	116½	My.21, Je.15 Q	1.75
St. Joseph Lead	New York	42½	41	41	Jn.10, Jn.21 QX	0.75
ZINC						
Am. Z. L. & S.	New York	7⅛	7	7	May., 1920	1.00⅞
Am. Z. L. & S, pfd.	New York	...	...	34	Nov., 1920	1.50
Butte C. & Z.	New York	4⅜	4⅛	4⅜	De.10, De.24	0.50
Butte & Superior	New York	10⅞	9⅝	9⅞	Se.15, Se.30 Q	0.50
Callahan Zn-Ld	New York	1⅞	1⅞	1⅞	Dec., 1920	0.50
Eagle Picher	Cincinnati	32½	32	32	Au.14, Se.1 Q	0.40
Eagle Picher, pfd.	Cincinnati	....	....	110	Aug.20, Sept.15 Q	1.75
New Jersey Zn.	N. Y. Curb	...	...	191	July20, Aug.10 Q	2.00
North Butte	Boston	2⅞	2⅞	2⅞	Oct., 1918	0.25
United Zinc	N. Y. Curb	...	...	*70		
Yellow Pine	Los Angeles	*15	*15	*15	De.8, De.18 Q	0.04
GOLD						
Alaska Juneau	New York	1	1	1		
Argonaut	Toronto	*29	*24½	*29		
Barry-Hollinger	Toronto	*67½	*58	*64		
Carson Hill	Boston	*25	**25	*25		
Consol. W. Dome L.	Toronto	*22	*20	*22		
Cresson Consol. G.	N. Y. Curb	2 7/16	2 7/16	2 7/16	Mh.31, Ap.10	0.10
Crown Reserve	Toronto	* 9⅛	*9	*9	Jan., 1917	0.05
Dome Mines	New York	10⅜	10⅛	10⅛	Jn.30, July 20, Q	0.50
Golden Center	N. Y. Curb	2⅛	1¾	2⅛		
Golden Cycle	Colo. Springs	...	...	2	Nov.30, Dec.10 Q	0.03
Hollinger Consol.	Toronto	19.50	19.00	19.30	Se.21, Oc.7 Q	0.10
Homestake Mining	New York	...	...	58	Se.20, Se.25 M	0.50
Kirkland Lake	Toronto	1.20	1.10	1.11		
Lake Shore	Toronto	14.70	13.45	13.97	Se.1, Se. 15 Q	0.10
McIntyre-Porcupine	New York	25⅛	24⅜	24⅛	Au.2, Se.1 Q	0.25
Newray	Toronto	...	...	*40		
Noranda	N. Y. Curb	19	18⅜	18⅛	...	...
Night Hawk Pen.	Toronto	*7	*6½	*7		
Portland	Colo. Springs	...	...	*43	Oc.6, Oc.15	0.02
Rand Mines	New York	...	...	36⅛	Au.23–30 Am.Sh.1	52
Teck-Hughes	Toronto	4.72	4.52	4.55	Jy. 15, Au. 2	0.05
Tom Reed	Los Angeles	*65	*65	*65	Ma.10 Ma.20	0.02
Tough-Oakes	Toronto	*48	*43	*44		
United Eastern	N. Y. Curb	...	...	*48	July, 1924	0.05
Vipond Cons.	Toronto	1.81	1.71	1.72		
Wright-Hargreaves	Toronto	8.79	8.57	8.60	Se.15, Oc.1 QX	0.07½
Yukon-Alaska Trust	N. Y. Curb	...	...	21		
GOLD AND SILVER						
Carnegie Metals	Boston	...	...	12½		
Con. Cortez	N. Y. Curb	*7	*7	*7		
Con. Virginia	San Francisco	*11½	*8½	*11¼		
Continental Mines	N. Y. Curb	....	....	*48		
Dolores Esperanza	N. Y. Curb	*95	*76	*90	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Se.15, Oc.4 Q	0.08
Tonopah Belmont	N. Y. Curb	3 3/16	3 3/16	3⅛	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	....	....	*46	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	5⅛	5⅛	5⅛	Ap.7, Ap.21 Q	0.07½
Unity Gold	N. Y. Curb	....	....	*30		
West End Consol.	N. Y. Curb	...	...	*18	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*27	*27	*27	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	...	...	1	Oct., 1920	0.50
Beaver Consol.	Toronto	*89½	*83½	*87	May. 1920	0.03
Castle-Trethewey	Toronto	1.44	1.40	1.40		
Comagas	Toronto	4.25	4.20	4.25	May, 1924	0.12½
Kerley	Toronto	1.65	1.59	1.63	Se 1, Se.15 X	0.12
Kerr Lake	N. Y. Curb	...	...	1	Oc.1, Oc.15	0.12½
La Rose	Toronto	*8	*8	*8	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	...	...	*50	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*12½	*12½	*12½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.72	3.58	3.58	Jy.1, Jy.15 Q	0.12½
Nipissing	N. Y. Curb	6⅞	6	6⅛	Se.30, Oc.20	0.15
Temiskaming	Toronto	*8	*8	*8	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	7⅞	7⅝	7½	Se.28, Oc.1, QX	0.25
Alta Merger	Salt Lake	†4	†2	...		
Bingham Mines	Boston	43½	42¼	42½	Se.20, Se.30 Q	1.00
Cardiff M. & M.	Salt Lake	*35½	*34	*34	De.16, No.18	0.10
Chief Consol.	Salt Lake	...	...	3.12½	Jy.10, Au.10 Q	0.10
Consti'n Mng. & Mill'g	Spokane	*50	*49	*49		
Emma Silver	Salt Lake	†1	†*50			
Erupcion	Boston Curb	1½	1 1/16	1⅜	Se., Oc.1, QX	0.15
Federal M. & S.	New York	82	81	82		
Federal M. & S., pfd.	New York	76½	76	76	Au.25, Se.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*13	*9	*10		
Hecla Mining	N. Y. Curb	17½	17¼	17½	Au.14, Se.15 Q	0.50
Highland—Surprise	Spokane	*18½	*18	18½		
Iron King Mining	Salt Lake	*47	*29½	*29½		
Keystone Mining	Salt Lake	*27	*27	*27	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*16½	*16	*16		
Lucky-Tiger Com.	Kansas City	9.20	9.00	9.00	Se.10, Se.20 X	0.07
Mammoth Mining	Salt Lake	3.00	3.00	3.00	Mar.24, Apr. 1	0.10
Marsh Mines	Spokane	2.50	2.25	2.37½	Se.15, Oc.19	0.15
Park Utah	New York	6.10	6.00	6.00	Se.15, Oc.1 Q	0.15
Plutus Mining	Salt Lake	1.90	1.90	1.90	July 15	0.10
Prince Cons.	Salt Lake	*4½	*3	4½		
Silver King Coal	Salt Lake	8.10	8.00	8.05	Jn. 21, July 1, Q	0.25
Silversmith	Spokane	*50	*49½	*50	Jn.30, Jy.10 Q	0.02
Strattons Mines	Spokane	*38	*34½	38		
Tamarack-Custer	Spokane	*27½	*27	*27½	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.50	11.87½	11.87½	Se.13, Se.25 QX	0.40
Utah-Apex	Boston	7⅞	7⅞	7⅞	Jy.3, Jy.15 Q	0.25
Western Utah Copper	N. Y. Curb	*5	*5	*5		
IRON						
Bethlehem Steel	New York	50⅛	46⅛	49½	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	82	80	82		
Colorado Fuel & Iron	New York	48⅛	43½	45	May, 1921	0.75
Gt. North'n Iron Ore	New York	21	20¾	20¾	De. 4, De. 28,	0.75
Inland Steel	New York	41⅞	41	41	Au.13, Se.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅛	1⅛	1⅛		
Replogle Steel	New York	10¼	9⅜	10⅛		
Republic I. & S.	New York	62	58	59½	Au.14, Se.1	1.00
Republic I. & S. pfd.	New York	99	98½	99	Se.15, Oc.1 Q	1.75
Sloss-Sheffield S. & I.	New York	131	127	128	Se.10, Se.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	104	104	104	Se.20, Oc.1 Q	1.75
U. S. Steel	New York	149½	143	144⅝	Se.2, Se.29 Q	1.75
U. S. Steel pfd.	New York	127⅝	126½	127½	Au.3, Au.30, Q	1.75
Virginia I. C. & C.	New York	...	...	46¼	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	...	...	72	Jn.1, July 2,	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM						
De Beers Consol.	New York	38	36⅝	38	Ju.16, Ju.17	1.70
So. Am. Gold & P.	N. Y. Curb	4⅛	4⅛	4⅞		
Alum.Co.of Amer.	N.Y.Curb	69	69	69		
Alum. Co. of Amerpf.	N.Y.Curb	102⅞	102	102	June 15, July 1, Q	1.50
Vanadium Corp.	New York	40⅞	39¼	40½	Au.2, Au.16, Q	0.75
ASBESTOS						
Asbestos Corp., New	Montreal	23	22	23	De.31, Ja.15 Q	1.50
Asbestos Corp., pfd.	Montreal	79	76½	77	Jy.1, Jy.15, Q	1.75
SULPHUR						
Freeport Texas	New York	28	26	26⅜	Nov., 1919	1.00
Texas Gulf	New York	169¼	165	167⅜	Se.7, Se. 15, Q	3.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	51⅛	50	50	Au.20, Se. 1, Q	1.00
Amer. Metal pfd.	New York	114⅝	114	114	Au.21, Se. 1 Q	1.75
Amer. Sm. & Ref.	New York	151⅛	144⅜	148⅜	Jy.10, Au.2, Q	1.75
Amer. Sm.&Ref.pfd.	New York	118⅛	117¼	118⅛	Au.7, Se.1, Q	1.75
Consol. M. & S.	N. Y. Curb	3⅜	3	3	Jn.30, Jy.5 QX	3.75
Federated Metals	N. Y. Curb	....	....	13		
Newmont Mining	N. Y. Curb	67	66	66	Mar.31, Apr.15,	0.60
Southwest Metals	N. Y. Curb	...	...	1		
U. S. Sm. R. & M.	New York	37⅝	37	37⅛	Jy. 7, Jy. 15, Q	0.87½
U. S. Sm. R.&M.pfd.	New York	48⅜	48⅜	48⅜	Jy. 7, Jy. 15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED SEPT. 7, 1926

Name	High	Low	Last	Last Divd Date	Amount
Aramayo Mines (25 frs.)	78/1½	77/6	77/6	Aug. 1926	15 p.c.†
British Platinum (£1)	4/1½	3/3	4/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	15/9	15/3	15/7½	Aug. 1926	7 annas*
Bwana M'Kubwa (5s)	7/6	7/3	7/4½		
Camp Bird (2s)	4/6	3/7½	4/6		
El Oro (£1)	8/6	8/1½	8/3	Nov. 1924	2½ p.c.*
Esperanza (10s)	1/—	—/9	1/—		
Frontino & Bolivia (£1)	7/6	7/—	7/6	July 1926	2½ p.c.
Mexican Corpn. (£1)	14/1½	13/9	14/—		
Mexico Mines of El Oro (£1)	26/3	25/10½	26/3	June 1926	7½ p.c.*
Oroville Dredging (£1)	3/9	3/6	3/9	Dec. 1923	3¾ p.c.
Ouro Preto (£1)	2/1½	2/—	2/—	May 1925	2½ p.c.
Rhodesian Congo Border (£1)	116/3	108/9	115/—		
St. John del Rey (£1)	9/6	9/—	9/—	June 1925	6½ p.c.
San Francisco Mines (10s)	34/6	32/10½	34/—	June 1926	15 p.c.
Santa Gertrudis (£1)	19/4½	18/—	18/9	July 1926	5 p.c.
Selukwe (2s. 6d.)	12/3	12/—	12/1½	April 1917	6¾ p.c.
S. Amer. Copper (2s.)	4/4½	4/4½	4/3	Nov. 1917	75 p.c.
Tanganyika (£1)	49/4½	42/6	46/3	Aug. 1926	7½ p.c.
Tomboy (£1)	3/7½	3/4½	3/6	July 1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.525	9.490	9.500	July 1926	175 (b)

* Free of British income tax. † Swiss frs. ‡ Belgian frs.